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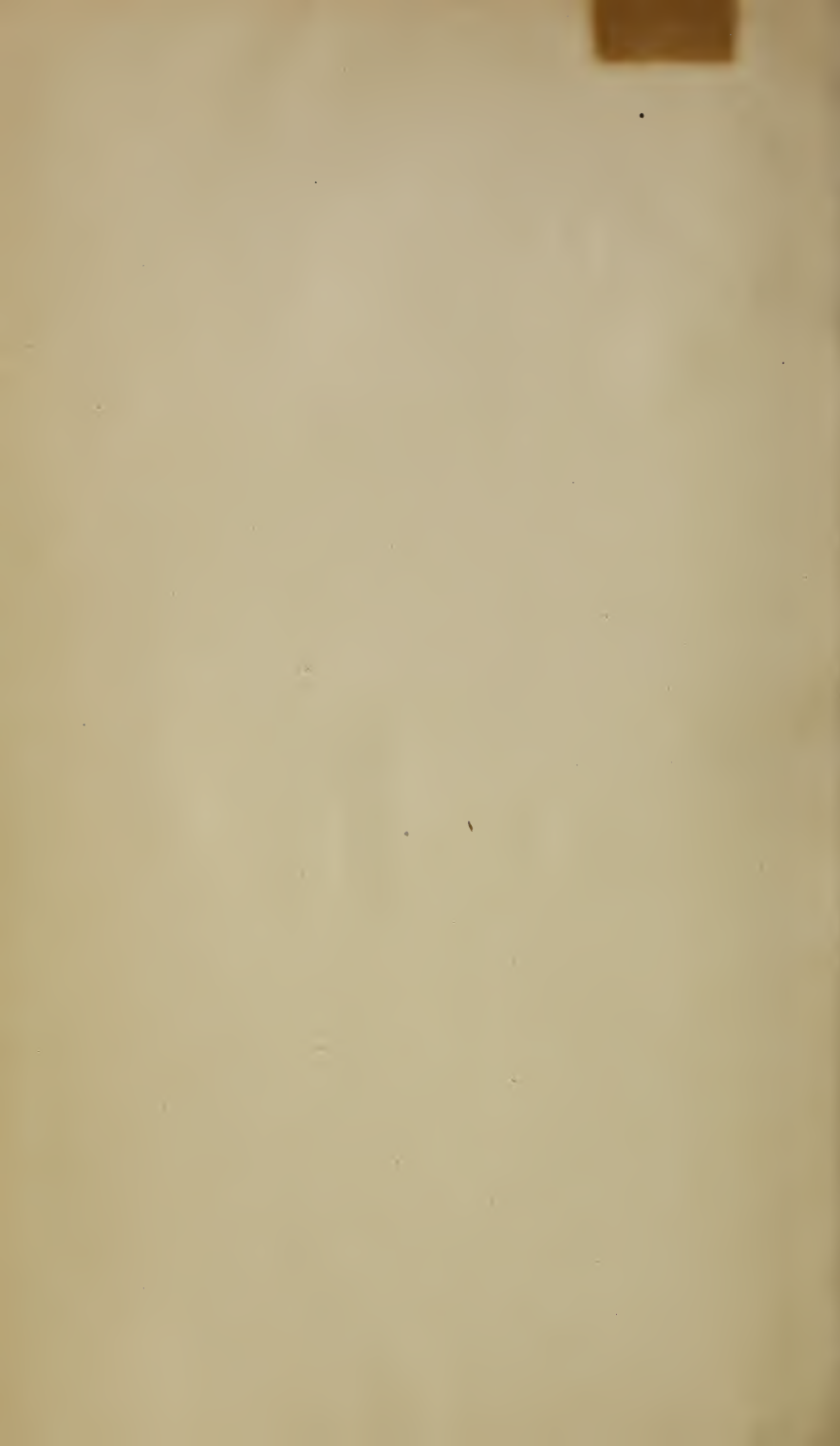
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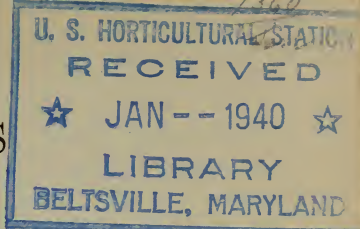
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PROGRESS



OF THE

BEET-SUGAR INDUSTRY

IN

THE UNITED STATES

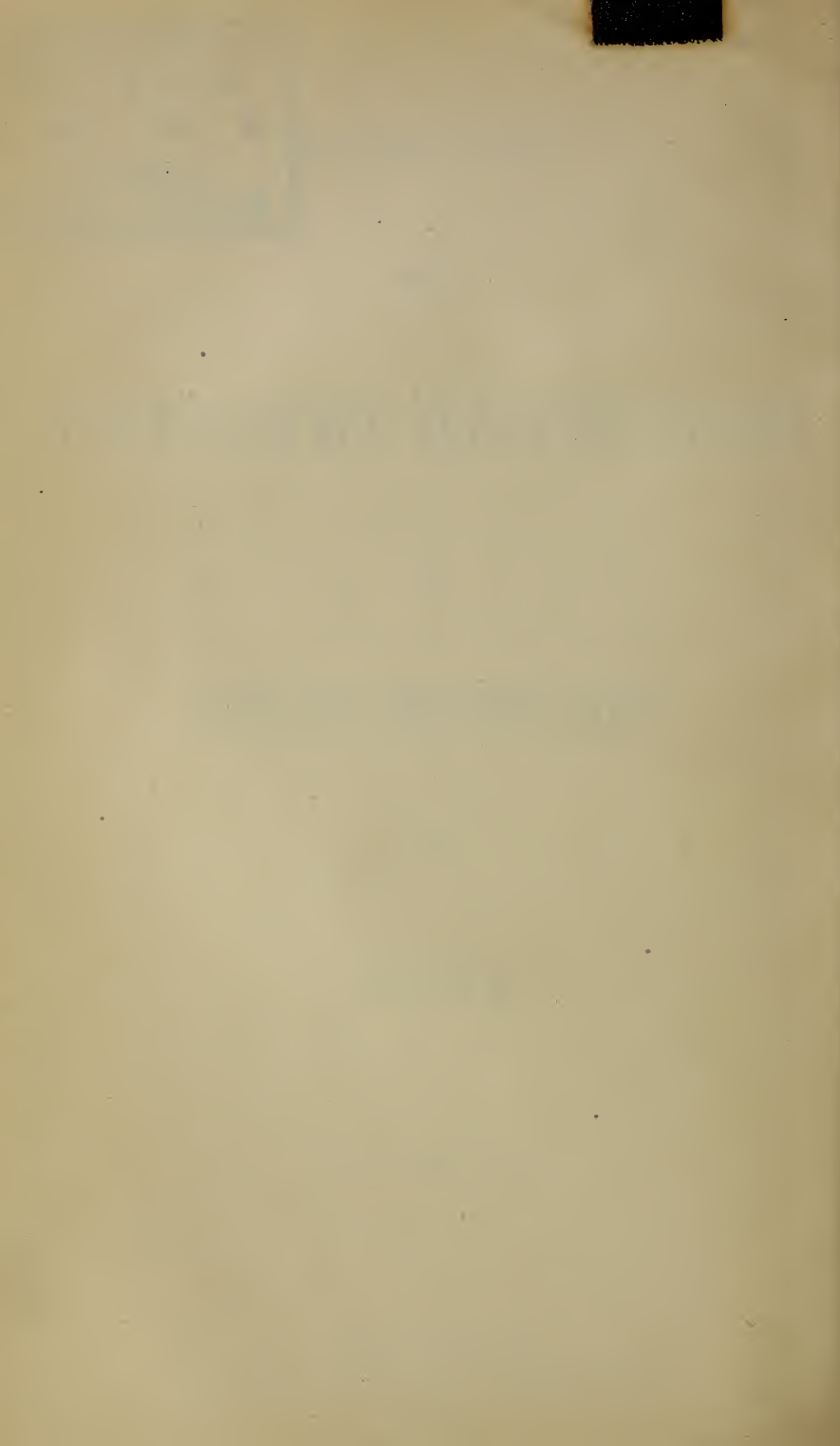
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1904.



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MESSAGE

FROM THE

PRESIDENT OF THE UNITED STATES,

TRANSMITTING

**A REPORT ON THE PROGRESS OF THE BEET-SUGAR INDUSTRY
IN THE UNITED STATES DURING THE YEAR 1903, TOGETHER
WITH A LETTER FROM THE SECRETARY OF AGRICULTURE
RELATING TO THE SAME.**

APRIL 1, 1904.—Read; referred to the Committee on Agriculture and Forestry and ordered to be printed.

To the Senate and House of Representatives:

I transmit herewith for the information of the Congress a report on the Progress of the Beet Sugar Industry in the United States during the year 1903, together with a letter from the Secretary of Agriculture relating to the same.

Your attention is invited to the recommendation of the Secretary that 10,000 copies of the report be printed for the use of the Department of Agriculture in addition to such number as may be desired for the use of the Senate and House of Representatives.

THEODORE ROOSEVELT.

WHITE HOUSE, *April 1, 1904.*

LETTER OF TRANSMITTAL.

DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., April 1, 1904.

MR. PRESIDENT: I have the honor to transmit herewith for your information and that of the Congress a report on the Progress of the Beet Sugar Industry in the United States during the year 1903, prepared by Mr. Charles F. Saylor, special agent of this Department. In view of the importance and continued interest in the subject, I have the honor to recommend that at least 10,000 copies of the report be printed for the use of this Department in addition to the number which Congress may in its wisdom order for the use of the members thereof.

I have the honor to remain, Mr. President,

Very respectfully,

JAMES WILSON,
Secretary.

The PRESIDENT,
White House.

LETTER OF SUBMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SPECIAL AGENT,
Washington, D. C., March 25, 1903.

SIR: I submit herewith, for your inspection and approval, my report for 1903 as special agent for the investigation of the sugar industry. It includes the results of my own observations and investigations, and a considerable mass of information pertinent to the subject collected from various reliable sources.

CHAS. F. SAYLOR,
Special Agent.

Hon. JAMES WILSON,
Secretary of Agriculture.

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PROGRESS OF THE BEET-SUGAR INDUSTRY IN THE UNITED STATES IN 1903.

INTRODUCTION.

In reporting the progress of the sugar industry for 1903 I feel impelled to recite particularly those things that affect its future status. In all my past reports I have dwelt at considerable length upon the importance of a general public knowledge of its needs and requirements. I feel gratified in announcing that the public is much better informed, in a general way, as to the relations of this industry to other interests of the country. It can safely be announced that the beet-sugar industry is no longer regarded as an experiment. It has become of so much magnitude and importance that we may consider it one of the established industries of the country, and it is especially gratifying to note that it is one which affects so many portions of the country.

The establishment of this industry, its progress and development, the building of factories throughout various States of the Union, have certainly been as rapid as the development of the necessary conditions which must sustain the industry. It is well worth while to examine carefully and critically what are the conditions upon which we can safely depend for the success of this industry in the future.

The expenditure necessary for building and equipping a modern sugar factory of sufficient practical capacity represents no small amount of money for a community of moderate means. We now have built and ready for operation in this country 56 sugar factories, 4 of which were not built in time for the campaign of 1903. Of these 50 were in operation during the past season and 11 were built and put in operation during the year 1903.

The great progress in factory building has been continuous during the past seven years. Each factory has had to work out its own conditions and establish its own resources. It may be safely stated that the career of each has been difficult and slow, but many of these factories have overcome the obstacles in their way, have established fixed resources and conditions, and are successful concerns under any ordinary circumstances. With many others it is still a matter of even

balance between cost of production and proceeds of operation. Some others, up to the present time, while making some progress, have probably not met expenses, while three factories established in this country in the past seven years have succumbed to the inevitable, have been dismantled, and their machinery devoted to other uses. The failure of these three factories is due to other causes than the impossibility of maintaining conditions necessary to successful sugar production.

In successful beet-sugar production it is found in practice that very much depends upon local experience and information concerning the various phases of beet growing and sugar manufacture. Much also depends upon the proper development of local advantages and conditions, and much more upon having sufficient time to accomplish all these results. It would be logical to suppose, then, that our older factories are the ones which have worked out most successfully the problems of beet-sugar production, and such is the case. It is safe to assume that with sufficient time and experience all of these factories will be producing sugar much cheaper and to the greater advantage of their farming communities than at present.

FACTORY EQUIPMENT.

It must be assumed that our factory equipment is all that can be asked. In the matter of machinery and processes we are certainly upon a favorable basis in comparison with any other beet-sugar country of the world. The beet-sugar industry has been developed in the older countries of Europe—Germany, France, Russia, Austro-Hungary, and others—within a comparatively recent period, say in the last half century. Rapid and marked progress has been made in the improvement of machinery and processes. Many factories have been greatly enlarged. While it is not my purpose to criticise the equipment of factories in the older countries, I think it is perfectly fair and proper to call attention to the advantages enjoyed by our own factories, which have recently installed complete plants with all the improved features incorporated. In Europe improvements have been made by adding the new to the old without that harmony of construction and operation found in the latest and best factories built in this country. The latter combine every feature that is most modern and most efficient in structure, equipment, and progress. Such factories yield a maximum of product at a minimum of expense for operation.

It is not to the factory or its equipment, therefore, that we must look for changes that will aid us in competing with sugar imported from other countries. Our new factories in this country must necessarily start with a limited amount of skilled labor, which they must increase by educating their employees. For this, only time and experience are needed and satisfactory results are soon secured.

AN AGRICULTURAL PROBLEM.

The success or failure of beet-sugar production in this country, in fact, resolves itself into a purely agricultural problem. While we possibly pay higher wages in the factory itself, the effect of this will be relatively small; and besides this disadvantage is largely compensated by the superior artisan ability of the workmen in the American sugar factory. The problem that most deeply concerns us is the supply and quality of the beets, a problem which affects both the farmer and the factory. The factory is interested in securing a sufficient amount of beets to maintain its operation for a hundred days or more. It not only requires a sufficient supply, but it requires beets of sufficient quality. Cheapness of sugar production depends largely upon a high percentage of sugar in the beets combined with a minimum of impurities. In order that the farmer can afford to grow the beets he must secure sufficient tonnage per acre to accept what the factory can afford to pay for them. He is also interested in the higher sugar content and purity, as in many cases the price he receives from the factory is not only based on tonnage, but also on the quality of the beets. It is clear, then, that with sugar tending to lower prices, or even continuing at present prices, the future of the industry is an agricultural problem and is dependent upon the amount and quality of the beets produced. Toward the solution of this problem we should direct our agricultural educational efforts. That we shall eventually produce a higher tonnage and a better quality of beets is apparent from the progress already made in communities where the industry is most firmly established.

In many of the communities surrounding the older factories the average tonnage has been increased 4 or 5 tons per acre. At \$5 per ton, the prevalent price for beets in this country, this means an increase of \$20 to \$25 in the earning power of an acre of land growing sugar beets. The average tonnage in Germany is about 13 tons per acre. The average tonnage in this country runs from 8 to 9 tons per acre. I think it is only fair to assume that when our farmers have been educated to use the same care in cultivation, fertilization, etc., we may expect from our lands a tonnage at least equal to that of Germany.

I have talked with many German beet growers visiting this country who have grown the crop extensively for years in the old country. In every instance they have expressed surprise at two things: (1) Our apparent slackness in sugar-beet culture; and (2) the comparatively large yields we secure with such methods. They also predicted that when the farmers of this country shall use in beet-growing methods as effective as those used in Germany we shall certainly produce a higher tonnage than that produced in the old country. I am thoroughly convinced that this country will eventually be able to grow an average of

15 tons of sugar beets per acre in the districts growing sugar beets by the aid of rainfall. This result will be secured when beet growing has developed to such an extent that our factory agricultural superintendents will be able to select for beet growing the choicest lands, and, what is of equal importance, the best farmers to grow the beets; and when these farmers shall apply the best known intensive methods of cultivation and fertilization. In the irrigated districts by the same methods we will have an average of 17 tons of beets per acre. At the prevalent price of \$5 per ton, this would produce in gross earnings from an acre of land in the rain districts about \$75, and in the irrigated districts about \$85. It costs on an average about \$30 an acre to produce sugar beets under rain conditions and about \$40 per acre to produce beets under irrigation. This would bring the farmer in either case average net earnings of about \$45 per acre. When we shall have realized this condition of things, without doubt every sugar factory will have its bins filled to their utmost capacity.

BEETS OF HIGHER QUALITY.

The beet-sugar industry in this country possesses another prospect that is yearly becoming more apparent and pronounced. In all the history of beet production in the beet-growing districts of the Old World beets have never attained the high sugar contents of those grown here. Sugar contents of 16 to 17 per cent are very high and exceptional for beets grown in Europe, yet we have factory districts in this country that will produce averages of 17 per cent and that will run often in carload and wagonload lots as high as 20 per cent. During the past season I received reports from all parts of the country stating that certain lots of beets went as high as 23 per cent, and a number of single beets showed as high as 25 per cent of sugar. This has been accomplished with the same seed that is grown and used in Germany, which shows the superiority of our conditions. As our soils get into better shape and as our farmers become more skilled in their manipulation, undoubtedly our growers will be able to furnish the factories beets yielding a much higher extraction of sugar than those produced in any other beet-growing country in the world.

Another prospect which is becoming equally apparent and which is equally important is the breeding of a higher strain of beet seed adapted to our own climatic and soil conditions. Sugar beets have already nearly trebled in their sugar contents since their first use in sugar production. It is claimed by scientists that they can breed a strain of sugar beets which will have an average content equal to that of the individual beet which is selected as the original mother. The Department of Agriculture is now carrying on cooperative experiments, through the Bureau of Plant Industry, with sugar beet seed

growers, for the purpose of increasing the sugar-bearing propensity of beets, and producing better strains. Starting with some of the high sugar-bearing beets grown in this country, there is a prospect, at least in theory, of a great improvement in sugar contents. The practical results are, of course, only problematic at this time. Viewing the sugar beet in the light of its history and improvement in the past, much improvement would seem possible of realization in the future. At present our factories produce about 220 pounds of sugar from a ton of beets. Some of our older and more efficient factories secure more sugar than this. By attaining a higher efficiency in the factory, through our workmen becoming more skilled, and developing a strain of beets from which we can secure an increased amount of sugar, along with our naturally superior conditions for producing beets of high quality, the factories of this country will be strengthened to meet the emergencies of the future whatever they may be.

HIGHER EXTRACTION OF SUGAR.

At present the average extraction of sugar by the factories in the United States is about 11 per cent of the weight of the beets. An extraction 1 per cent higher would mean 20 pounds more sugar from a ton of beets, which at $4\frac{1}{2}$ cents per pound (the prevailing price) is worth 90 cents. An extraction 2 per cent higher would mean 40 pounds more sugar, worth \$1.80. An increase of 3 per cent in the extraction would mean 60 pounds more sugar, worth \$2.70; and an increase of 4 per cent, 80 pounds, worth \$3.60.

If the farmers were receiving from 15 to 17 ton of beets per acre this would also have a tendency to reduce somewhat the cost of beets to the factory. From this discussion it can be plainly seen that the American beet-sugar industry must accomplish these higher ideals before its absolute perpetuity and invulnerability are assured.

In this report I show many incidental benefits and advantages of the industry, such, for instance, as the utilization of by-products, the many local improvements that result from the establishment of a factory, and improvements in agriculture.

INCREASED POPULAR INTEREST.

During the past season there were many indications that the industry is reaching a higher place in the minds and interests of the people and attracting the attention and receiving the investigation of influential public men. As illustrations of this the following facts are given:

The President of the United States, during his trip to the coast last year, took a side trip up to Oxnard, Cal., especially to investigate the wonderful mechanism of sugar production at that place.

The Secretary of Agriculture, in company with the Congressional delegation from Michigan, took a trip over that State, inspecting and investigating its beet-sugar industry.

The Emperor of Germany delegated a corps of leading scientists of that country to travel over this country, inspecting our methods and resources in connection with beet-sugar production.

Nearly all the railroads of the country organized trips over their lines, in which leading officers, accompanied by capitalists and beet-sugar experts, investigated the resources for beet-sugar production along their various routes.

It was a common occurrence during the year for farmers who had been experimenting in beet growing in districts remote from sugar factories to organize excursions to beet-sugar factories for the purpose of investigating the advantages and requirements of such institutions.

At the Trans-Mississippi Commercial Congress, which met at Seattle, Wash., and the National Irrigation Congress, which met at Ogden, Utah, probably no other subject discussed received as much attention, time, or favor as the beet-sugar industry. In both instances resolutions were adopted strongly tending to foster and encourage beet-sugar production throughout the country.

DEVELOPMENT OF CONDITIONS AND NEW FACTORIES.

ARIZONA.

When the experimental period of the beet-sugar industry was at its height Arizona took a leading part. Many of its valleys were tested to ascertain the general condition of that State for growing sugar beets and manufacturing sugar. The results of these experiments indicated conditions and resources in many parts favorable to this industry. Capital did not readily respond to this demonstrated opportunity. It took time to impress the facts sufficiently on capitalists to secure the money for building a factory and making a trial test.

The beet-sugar industry is a many-sided problem which must necessarily be worked out in this country in the school of experience. In its earlier stages it was the firm belief of its leading exponents that the beet-sugar industry was better adapted to States in the corn belt, such as Indiana, Michigan, Ohio, Illinois, and Iowa. Naturally, capitalists were influenced by the views of leading agriculturists, and were chary of risking money in a beet-sugar enterprise in the arid belt. But more recently the sugar industry has taken a strong hold in the arid West. There are two reasons for this: (1) Necessity has compelled these western people to make a closer study of things adapted to their conditions; (2) they have been more united in their efforts to secure the capital to develop their resources.

Sugar factories at Rocky Ford and Sugar City, Colo., depending entirely on irrigation for the growing of crops, opened the eyes of

the world to the extensive opportunities throughout the mountain and arid States for successfully growing sugar beets and manufacturing sugar. Several times there has appeared to be a good prospect for the establishment of a factory in Arizona. Salt River Valley and other valleys of the Territory were studied by experts representing different investors. Finally the efforts to establish the industry culminated in the organization of the Eastern Sugar Company, representing largely Michigan capital and incorporated in the State of New Jersey. A factory was located and is now building about 8 miles northwest from Phoenix, at a point called Glendale. It will have a capacity of about 800 tons of beets per day. The factory is of the most modern pattern, the building being of brick and steel, and to be equipped with the most modern machinery. The factory is partially completed and some of the machinery has been installed, but it probably will not be put in operation until the campaign beginning May, 1905. It has an acreage contracted approximating 8,000 acres. It was to have been completed for the spring campaign of 1904, but scarcity of money delayed its completion.

The manufacture of beet sugar throughout the United States will be practically continuous during the whole calendar year. This factory in Arizona will run in the spring and early summer; those in California make sugar during the summer; those in the mountain States, during the fall and early winter; and those farther east, in the late fall and winter. The Arizona factory will begin manufacturing sugar about the time beets are planted in Minnesota, Iowa, New York, Ohio, and other Northern States dependent upon rain. The planting season in Arizona will begin at the time factories in the Northern States begin the manufacture of sugar.

After trial in Arizona a different season may be found better adapted to growing sugar beets, but at present the winter seems most desirable. The Glendale factory is the first located in a district watered by irrigation ditches or reservoirs built by the Government of the United States. Its existence is dependent entirely upon the new irrigation and reclamation act passed by Congress recently, appropriating all the moneys received by the Government from the sale of public lands for the purpose of building storage reservoirs and distributing ditches for reclaiming arid lands. The factory at Glendale will be the first to demonstrate the beneficence of that act of Congress, which will eventually reclaim millions of acres of land now sterile from lack of water. Other sugar factories will doubtless follow, bringing this land into use in intensive and profitable agriculture.

Agriculturally, Arizona, like the mountain States farther north, has been noted chiefly for grazing, but mining is her principal source of wealth. This sugar factory will contribute materially to the prosperity of both grazing and mining. The grazer will find the pulp pro-

duced by the factory valuable food for his stock; the mining camp will find sugar, one of the necessities of life, at its very door. This sugar factory, and others which will probably follow, may revolutionize the economic conditions of the Territory, and produce many changes materially helpful.

The factory will pay to the farmers in the vicinity annually \$325,000. It will also pay out large amounts to the coal mines for fuel, to the laborers as wages, to the quarry owner for lime rock, and for other local purposes, aggregating \$400,000 or \$500,000. This vast expenditure must be materially beneficial to all local interests. It will find its way to the merchant; it will mean a market for draft horses and many other things; it will help carry the burden of taxation; it will encourage improvement, immigration, and settlement.

COLORADO.

One visiting Colorado at the present time can not help being greatly impressed with recent developments. In various portions of the State devoted to agriculture acre after acre and farm after farm are devoted to the growing of beets. Looking up and down the valley one can see the smoke belching forth from the tall chimneys of sugar factories. If such a visitor were a citizen of Colorado, returning after an absence of four years, he would certainly denominate the sight as a transformation scene.

Five years ago no evidence of this industry existed, but leading agriculturists of the State were convinced of its favorable conditions for growing sugar beets and producing sugar. The agricultural experiment station had conducted many experiments, so had farmers and others; but capital hesitated for the reason that the agricultural resources of Colorado were so limited and undeveloped. There was no general information practically useful in the production of sugar beets. The success of fruit production at Grand Junction and other places, of potato growing at Greeley and in the northern part of Colorado, in conjunction with small grains, was well understood. The Arkansas Valley had gained a reputation through the fame of the Rockyford melons. The State was known generally to be resourceful in the production of alfalfa, where sufficient moisture could be obtained, either through rainfall or artificial means. Finally, that beet-sugar veteran, Henry T. Oxnard, of California, who had organized the American Beet Sugar Company, and had established factories in Nebraska and California, was attracted by the resources of the State of Colorado, and established a factory at Rockyford.

In the development of the beet-sugar industry of Colorado the beet crop came in competition with several other special crops, of whose success and profit the people of the State were well aware. While this has been the case throughout the United States, it is especially

true of Colorado. Grand Junction won fame in the production of deciduous fruits, yet this was the first place selected for the establishment of a beet-sugar factory. Rocky Ford had gained a world-wide reputation in the production of melons, and this was the second place. Then followed the installation of the factories at Loveland and Greeley, famous for their profitable production of potatoes and wheat. Through the success of these various plants followed the installation of others, until at present the State has nine large sugar factories, and several others are either in the process of construction or organization. Sugar beets as a farm crop had to enter into competition with the favored crops already mentioned, and it is remarkable that under such conditions it succeeded, and in so short a time. It occupies a well-established position in the State of Colorado to-day.

This State has immense mining interests. It is dotted from the north to the south, from the east to the west, with mining camps and towns which are calling upon the productive resources of the State for their daily sustenance. It is responding in a rapid development of its agricultural resources to meet this demand. In the growth of population the demand for sugar is rapidly increasing. The State is also developing a fruit industry which offers a constantly increasing demand for sugar as a raw product in the preservation of fruits. As in other mountain States every acre not used for general farming or fruit growing, or by precipitous mountains, is available in some degree for grazing. By reason of this its stock interests are important. The sugar factories, by furnishing large quantities of pulp, are aiding the stock industry. In the future it will not only furnish lambs and steers for the eastern farmers to fatten, and young horses for them to develop through feeding and training, but it will be able with its own grains and pulp to do these things at home. Conditions are especially favorable to dairy industries, and the State will be a formidable competitor of its eastern neighbors in the production of butter and cheese. The pulp from the beet-sugar factories is more useful as a feed for dairy cows than for almost any other purpose.

Of the nine factories fully equipped for business eight are in active operation, and every arrangement has been made for the future usefulness of the ninth, located at Grand Junction, which has been temporarily suspended for the past two years. This was due to lack of local sympathy and capital in meeting the strenuous competition of a favored crop. It had more to contend with than any other of the factories in the State. The farming lands of that section are especially adapted to the production of the finest varieties and the best qualities of deciduous fruits. The growers knew the possibilities of these. They were reluctant to turn over their best lands to the production of something new. The closing of the factory was followed by a better appreciation of its benefits. Its opening argues better success.

While other factories in the State had to meet the same obstacle, they did not have to meet it in the same degree. They were better equipped for overcoming inertia and opposition. The areas tributary to these nine factories are capable of producing, under ordinary conditions, with a fair acreage, about 630,000 tons of beets annually. These factories constructed in the last four years in the State of Colorado will pay annually to the farmer alone about \$3,150,000. They will pay for fuel, labor, transportation, and other local needs nearly as much more.

Can anyone consider the effect of annually distributing approximately \$6,000,000 in these nine localities and not appreciate the great benefits of the sugar industry to Colorado? When we consider that in the next few years this number of localities may be greatly increased we can realize the transforming effect of the industry on the agriculture of the State. If we add to this the aid given by this industry to other industries, such as dairy farming and stock feeding, the employment of labor and capital, merchandising, etc., we begin to grasp the importance to Colorado of the development of this industry. But the benefits do not stop here. Scientific methods, introduced through the cultivation of sugar beets, improve the farms and the farmers of the State and increase the yield and quality of all other crops. Through the rotation of crops, extermination of weeds, cultivation, and soil improvement, the land is made more productive. The value of these advantages can not be computed, but they are apparent to everyone producing sugar beets along with other crops.

There is a general business stimulus which goes with the beet-sugar industry which is of great importance to the communities affected. The establishment of a sugar factory is the forerunner of other improvements. For instance, it requires considerable investment to build irrigation ditches, but capital is ready to invest in this project if it sees a sure demand for water. In the arid districts the establishment of a sugar factory promotes the building of irrigation ditches. It insures future support. General cropping is necessary in growing beets. To meet the demands and supply the needs of a sugar factory, railroads are extended, trolley lines are built, and many other improvements are made.

There is a number of additional places in Colorado where plans are under consideration, or have already been consummated, for establishing sugar factories in the near future. The following are some of the places:

Brighton.—For some time farmers in the vicinity of Brighton have been growing sugar beets for factories at other places, but there has been considerable talk during the past summer of erecting a sugar factory at this place. Overtures have been made to the business men of this locality and these have been seriously considered. A committee was

appointed to secure acreage, with every prospect of success, and there is a very strong probability that this locality will in the near future have a factory with a capacity of at least 500 tons daily.

Sterling.—At this place outside capitalists and others having local interests have been seriously considering a project to establish a sugar factory. Sterling is in Logan County, which is situated in the north-eastern part of the State. The town is on the Platte River, and is the junction point of the Burlington and Missouri River Railroad and the Union Pacific.

The past season there were grown in this section about 2,300 acres of beets for other sugar factories. In this locality beets have been produced experimentally for some time. A factory at this place would have the advantage of the experience thus acquired. Contracts have been made with the farmers here for growing beets three years, beginning with 1904, as the basis for establishing a sugar factory. The following plan has been most favored: The owners of the land will sell to the sugar company 10,000 acres. This land will be put under an irrigation ditch, which will give it a stable value. The parties selling the lands to the sugar company are to receive for them the company's stock at par, and an additional amount of stock is also to be subscribed for. Upon this capital and land values owned by the sugar company, bonds are to be predicated to the extent of \$1,000,000, and the money realized from their sale is to be used in building and equipping a sugar factory. The factory is to have a capacity of about 1,000 tons of beets daily. A site for the factory has been selected near Sterling and on the banks of the Platte River. From the results heretofore achieved in growing beets in this locality, it looks as though the factory might start under very auspicious circumstances. Below is given a report made by C. B. Goddard, of Sterling, regarding results of sugar-beet growing at that place during the past summer:

DECEMBER 26, 1903.

DEAR SIR: The following report is submitted in compliance with your request of December 19, 1903:

1. There were 2,300 acres of sugar beets raised in Logan County, all of which were irrigated with water taken from the South Platte River. The beets were raised under contract with the Eaton Sugar Company, of Eaton, Colo., and were shipped to that company's sugar factory.

2. The price paid was \$5 per ton delivered at the factory, which netted the farmers \$4 here; the agreed price for beets in future is \$4.50 per ton here.

3. The beets raised in Logan County averaged about 16 per cent in sugar, many individual fields going to 18 per cent. The average tonnage was about 8 tons.

4. L. P. Collier living one mile north of Sterling had a 15-acre crop which yielded about 20 tons per acre; his total cost of production and marketing was about \$37.50 per acre; this crop was raised on sandy loam soil. W. H. Bennet had in 10 acres, which yielded upward of 15 tons per acre; these were raised on low, heavy bottom lands, the cost of producing being about \$35 per acre. The Sterling Beet Growers'

Association raised 80 acres of beets one-half a mile west of Sterling, on ground that had never been tilled. It had been in alfalfa, the alfalfa having been sown on the sod. This land was too tough to be plowed by horses, and was plowed by a steam plow. The yield was about 10 tons per acre. The cost of production was about \$45 per acre. The Logan County Beet Growers' Association raised about an equal number of acres with about the same conditions and results.

5. All our farming is done under irrigation. We have plenty of water from the Platte River to irrigate our farming land. The water is used in the ordinary way for irrigation. We have learned from experience that it is an easy matter to irrigate too much for best results. We give our land a good irrigating in the late fall, which leaves it in good condition for early spring cultivation.

As to the prospect of a sugar factory, the chamber of commerce holds almost 6,000 acres of acceptable contracts from our farmers, which are for the growing of beets for the years 1904-1906, and has the promise of sugar factory for 1904 from parties who are interested in the manufacture of sugar.

Experts claim the soil and general conditions for producing profitable sugar beets is nowhere better than in Logan County, which has three lines of railroad and is the center of a large and well-irrigated district. Sterling will be able to supply 20,000 acres of beets annually out of 200,000 acres irrigated lands in Logan County. This country has not been developing along agricultural lines, consequently there was very little land in proper condition to grow beets, the people having been engaged extensively in the cattle business. Those engaged in the growing of this year's crop give as a reason for the seemingly light tonnage the fact that the conditions this year were badly against the beet business because of a very late spring and an unusually late frost, which caused much replanting. Also, the labor situation was such that the beets could not be given proper hand labor at the required time. With the usual conditions our crop would have averaged 12 to 15 tons per acre.

The foregoing is respectfully submitted by

STERLING CHAMBER OF COMMERCE,
C. B. GODDARD, *Secretary*.

Bloomington.—For some time there has been considerable talk about establishing a beet-sugar factory down in what is known as the Castlewood lands, located about 16 miles south from Denver, in Arapahoe County. Considerable money has been spent in the building of a dam protecting a reservoir. There are to be several reservoirs storing a large amount of water which is supplied by Cherry Creek. It is presumed that Cherry Creek will fill up the first and largest reservoir. It is arranged that the ditch flowing from this main reservoir shall conduct the overflow of water into several subsidiary reservoirs. A large area of land will be accommodated through this storage system.

The Denver Sugar Land and Irrigation Company owns from 17,000 to 18,000 acres of land; it proposes irrigating these lands through the system just described. Several thousand acres of land have been sold to the actual settlers, and the company has promised to build a beet-sugar factory so that the lands can be utilized in growing beets. It is reserving 5,000 acres as the property of the plant. This project has had its downhill career, but it is believed by those best informed that the factory will be built next year.

There are many advantages in locating a factory in such close proximity to Denver, a commercial center. Bloomington is simply a town

site about 16 miles south of Denver, and whether it becomes a town in fact depends entirely on the success of this company in establishing a sugar factory at this point. In case it succeeds we will have another town in Colorado similar to Sugar City, owing its origin and prosperity entirely to the beet-sugar industry.

The site of Bloomington is $2\frac{1}{2}$ miles from the tracks of the Elizabethan branch of the Colorado Southern system. This road is now not much used. The sugar factory would rejuvenate the road. Another road is contemplated from Denver to the Castlewood lands.

It is planned to build a plant of 500 tons daily capacity.

Fountain.—A company has been organized to build a beet-sugar factory on Fountain Creek near Colorado Springs. The company has a storage reservoir. It has purchased several thousand acres of lands, and is contemplating arrangements with the city of Colorado Springs for utilizing the entire sewage of that city for irrigation and fertilization. The claim is made that there is enough moisture in the sewage to serve 6,000 acres of land. The company is constructing an irrigation system, supplied in abundance by Fountain Creek and furnishing water to 20,000 acres. As soon as these lands are available for beet growing and other cropping, a factory is to be built, retaining a large acreage for growing beets, which will be the staple crop of the valley. This project is especially interesting on account of the experiment in utilizing the sewage from a large city like Colorado Springs for fertilizing purposes.

Brush.—For some time there has been considerable talk about establishing a beet-sugar factory at this place. It is in the same part of the State as several of the established factories, whose beets are grown in what is known as the potato district, including Greeley, Eaton, Longmont, Loveland, and Fort Collins.

During the past year the farming community around Brush grew a large acreage of beets which were delivered to the factories farther west. This was attended with success both in quantity and quality of the beets.

Brush is located on the Platte River, on the Burlington and Missouri River Railroad, and also near the Union Pacific, which runs on the opposite or north side of the river at this point. It is about half-way between Denver and the eastern boundary of the State, and in a practically new irrigated district, which has shown quite favorable results in producing the usual crops of that part of the State.

Durango.—A company was organized at the above place, known as the Ute Light, Power, and Irrigation Company. Its object is to procure lands, irrigate, grow sugar beets, and establish a beet-sugar factory. It has acquired about 12,000 acres of land. One of the necessities of a sugar plant established in practically new territory, requiring the reclamation of arid lands, is ownership or control of

land. This is to insure sufficient beets to keep the factory in operation. It is easier to import day laborers and renters to perform a specified amount of work in a short period than to occupy the land with settlers. Permanent settlement under any circumstances is too slow for the requirements of a sugar factory in a new and unsettled district.

Grand Junction.—At this place was built the first factory established in Colorado. It has a capacity of 350 tons of beets per diem. It is of modern pattern both in structure and equipment; is built of steel and brick, and, considered from a factory standpoint, has every facility for success. In other reports discussing this factory and its obstacles I have suggested that the farmers of the community were too much wedded to the fruit industry to take kindly to the production of sugar beets, or even to give them a fair trial. For a couple of years, that did not bring out fully the advantages of the sugar-beet industry in that locality, lands that were not readily available for fruit culture were put in sugar beets; beets were used as a cultivating crop for orchards; lands being reclaimed from a wild state were also put into this crop. The beet fields served the purpose of reclaiming and improving lands for the fruit industry. Naturally the result of this was the shutting down of the factory. It appears the concern did not have sufficient capital to overcome these obstacles and suspended operations for the past two years.

During the summer some capitalists at Colorado Springs, Colo., and Scranton, Pa., organized the Western Sugar and Land Company, with headquarters at Colorado Springs and suboffices at Grand Junction, Colo., and Scranton, Pa. The company is capitalized for \$1,000,000, has acquired the entire holdings of the old sugar company, and has purchased about 4,000 acres of land in addition thereto. This company has made a careful canvass of the Grand Junction district, and, in addition, those of Delta, Montrose, Fruita, and some other points. It is claimed they have sufficient acreage to grow beets for the fall campaign, and have announced the opening of the factory for 1904. The encouraging features are sufficient capital and sufficient land controlled by the plant to insure a supply of beets. This puts it in a position to overcome the shortage of beets hitherto resulting from unwillingness of the farmers to grow them.

In interesting the farmers around Delta, Montrose, and Fruita the supply territory is much widened. Each of these places is seeking the location of a sugar factory in the near future. This encourages beet growing for the testing of local conditions. This pioneer and experimental work can be made both profitable and educational under the market and direction of the factory at Grand Junction. At the same time the factory will receive a supply of beets.

The lands which the sugar company own will gradually develop into first-class condition for the production of sugar beets, lessening each year the liability of a shortage of beets.

The new company is offering \$5 a ton for beets delivered to any point ready for shipment. In order to arouse a sentiment favorable to sugar-beet growing, the management of this new company at its own expense took 20 of the leading growers from these various places to Loveland, Colo., for an ocular demonstration of the real value and importance of a sugar factory to a farmer when it receives the right kind of support. At Loveland sugar-beet growing is becoming the principal feature of farming. Sheep raisers, dairymen, and farmers generally unite in favorable testimony of its benefits. These visitors went back to their various localities very favorably impressed and advising better cooperation with the sugar factory and more attention to beet growing. This factory will resume business with every indication of a successful and continuous future career.

Craig.—It is reliably announced that arrangements have been made for the building of a new irrigation ditch covering a large body of land near this place. The ditch is to be 45 miles long, and the supply of water is to come from a fork of Snake River. The objective point in view is the building of a large beet-sugar factory.

Sterling.—There are two companies planning to build beet-sugar factories at Sterling. The company representing the factory at Loveland, Colo., has made a proposition to establish a plant at this place if local interests will procure contracts for growing the beets on 3,500 acres. Representatives of the American Beet Sugar Company are negotiating with some parties with the purpose of establishing a factory at this place. It seems quite probable that by one or the other of these parties a factory will be built.

Lamar.—For several years beets have been grown at this place for the sugar factory at Rocky Ford with quite favorable results. They were so favorable, in fact, that an organization was effected among the business and farming interests in this district, and negotiations were taken up with Mr. Henry T. Oxnard, the president of the American Beet Sugar Company, with a view to establishing a factory at this place. Recently contracts with 400 growers for 6,000 acres were procured and Mr. Oxnard entered into a contract to build a 1,000-ton factory here in 1904. It was stipulated that if the factory was not erected in time for working the beets in 1904, they were to be shipped to Rocky Ford, where one of the factories of the American Beet Sugar Company is located.

Las Animas.—For some time the citizens of this place have been endeavoring to procure a beet-sugar factory. Recently it was reliably announced that a plan had been matured and arrangements had been

made for the establishment of a factory of 1,000 tons daily capacity. This project is under the direction of capitalists representing other beet-sugar interests, located in Colorado Springs and in Michigan. The company is to own about 3,500 acres of land as a guaranty of its supply of beets.

Julesburg.—This place has the agricultural conditions, the public sentiment, and a favorable prospect of a beet-sugar factory. It is in Sedgwick, the northeastern county of Colorado, on the line of the Union Pacific Railroad, and is quite a lively railroad point. Its agricultural district is penetrated by three irrigation systems, viz, the Peterson, the Settlers, and the South Reservation, and it has about 40,000 acres available for agricultural production.

Among other things, sugar beets have been grown to a considerable extent. A liberal supply of beets may also be drawn from the irrigated district just east and contiguous to it in the State of Nebraska. Attention had been attracted to the favorable quantity and quality of beets produced. Parties are negotiating to establish a beet-sugar factory at this place. The following is a report, made by Mark Burke, of Julesburg, regarding the results of growing sugar beets at this place during the past summer:

JULESBURG, COLO., *December 25, 1903.*

DEAR SIR: Although this was the first year that any effort was made to raise sugar beets in this county, 700 tons were shipped from here, 550 tons going to Eaton, Colo., and 150 tons to Grand Island, Nebr. Those sent to Eaton were contracted for at a "flat price" of \$4 per ton. Grand Island paid according to saccharine matter, as tested, and averaged \$5.05 per ton. Average per cent of sugar at Grand Island was 18.2. The best piece was 3 acres, averaging 12 tons per acre. Cost of raising was \$30 per acre. We irrigated from the South Platte River, but it is dry most of the time in summer. There are 40,000 acres undersuch ditches. We could get a factory if we could get a reservoir built which would cost \$150,000 and hold 25,000 acre-feet. There is a good water supply in winter. We are making efforts to build a reservoir, but capital is limited.

Respectfully, yours,

MARK BURKE.

Under the influence of irrigation the area of development of the beet-sugar industry is gradually extending westward along the Platte, while in Colorado the area of development is extending eastward. Eventually they will meet somewhere out in what was once the arid waste lands of eastern Colorado or western Nebraska. The Platte River is the line of march of this industry. Once all the waters of the Platte mingled with those of the "Big Muddy" and passed on to the sea without being of any practical use either to commerce or agriculture. Now nearly all the water of both branches of the Platte is utilized for irrigation.

IDAHO.

For the last seven years Idaho has been a field for active investigation by sugar-beet experts, and a great many localities have been found

to have favorable conditions for maintaining the sugar industry. Last winter the legislature of the State passed a law giving a bounty of 1 cent per pound for all sugar manufactured in the State in 1903 and a half a cent per pound on all sugar manufactured in 1904. A factory was immediately established in Bingham County, at Idaho Falls, on the Snake River, in the southeastern part of the State.

Sugar City.—The Idaho Falls factory was followed by the establishment of another factory by the same parties, under the name of the Fremont Sugar Company, at Sugar City, at a point between Rexburg and St. Anthony, near the Snake River. The factory will be completed and in operation for the campaign of 1904. It will have a capacity of 600 tons of beets per day. It will be constructed in such a manner that it can be easily equipped for twice this capacity. The company has secured contracts with the farmers for growing 5,000 acres of beets during 1904. It has purchased a section of land, laid out a town site, and named it Sugar City. It is located in the southern part of Fremont County, which is in the northeast corner of the south expansion of the State. This will be the second year under the bounty law. The 5,000 acres under contract should produce in the neighborhood of 5,000 tons of sugar, on which the bounty will be about \$50,000. This will compensate materially for the losses which every new factory has to suffer in starting its new machinery with new workmen and adapting itself to new conditions. This estimate of sugar production is based on the work of an ordinary factory of its capacity, under average conditions. The results with a new factory in an entirely new locality might drop considerably below this figure.

Sugar City is located on the Oregon Short Line, and is in a position to supply the demand of a large mining district. The plans provide for a slicing station located on the Egin River bank, about 12 miles distant, from which the juices will be piped down to the main factory. This station will have a capacity of working 600 tons of beets, and this will increase the capacity of the factory to 1,200 tons per diem.

Nampa, Boise, and Caldwell.—Capitalists from Salt Lake City have been exploiting the agricultural conditions of what is known as Boise Valley, especially around Boise, Caldwell, and Nampa, the two last towns being on the line of the Union Pacific Railroad a short distance from Boise City, which is on a stub of this road about 13 miles in length.

There has been a lively contest during the past summer as to which would secure the sugar factory, the parties interested having determined to build at one of these three places. The contest for the location was largely dependent upon which could secure the largest acreage and offer the best inducements for a factory location. It seems to be settled that a factory will be built at one of these places and Nampa appears to be in the lead. However, it is probable that the

sugar factory will draw from all these districts, once it is located, and it may be followed by the location of a factory at one or both of the other places in the near future. The company asks for contracts with the farmers for 5,000 acres and offers to pay \$4.50 per ton for beets. Below appears a report from W. A. Sample relating to the experiments in sugar-beet growing at this place, the efforts to secure a sugar factory, and the prospects:

CALDWELL, IDAHO, *December 28, 1903.*

DEAR SIR: Your recent letter received and contents noted. I only wish that it was possible for me to report that we had a factory in operation, but as it is a vast enterprise, requiring time to establish, we feel encouraged over our prospect for 1905, and if the bounty is not knocked out we will build for the season of 1904. There were no beets raised for factory use this year in the Boise Valley. Several small patches of one-half acre to an acre were grown, the yield being good. Mr. W. E. Bolton, 3 miles from Caldwell, grew one-fourth of an acre, and his yield was $8\frac{1}{4}$ tons, making 33 tons per acre. Beets were on exhibition at the Caldwell fair, grown from seed planted on June 15, that weighed $1\frac{1}{2}$ to 2 pounds, with 18 per cent of sugar and a purity coefficient of 86. I am sorry I can not give you the information you want in detail.

Very truly, yours,

WM. A. SAMPLE.

Blackfoot.—A company was organized at Blackfoot, Idaho. This is in the southeastern part of the State, in Bingham County, near Snake River, and on the Oregon Short Line Railroad. The name of the company is the Snake River Valley Sugar Company, and the concern is capitalized at \$1,000,000. The purpose is to erect a beet-sugar plant at this place. This section of the country has been thoroughly tested and has very favorable conditions for growing sugar beets and manufacturing sugar.

Mr. W. D. Trego, treasurer of the Snake River Valley Sugar Company reports on the samples of beets shown at the county fair at Blackfoot, in September, 1903, as follows. These samples appear to have come from several counties in the Snake River Valley.

BLACKFOOT, IDAHO, *September 21, 1903.*

Sugar beets grown by C. W. Rockwood at Iona, Bingham County, Idaho, for Idaho Sugar Company; planted April 27, 1903; grown from original Kleinwanzlebener seed: Patch of 23 acres; estimated yield, 20 to 22 tons per acre. Sampled September 11, 1903. Number of beets, 5. Average weight, $1\frac{3}{8}$ pounds. Brix degrees, 17.4; sugar in juice, 15.2 per cent; purity coefficient, 87.25.

Sugar beets grown by Idaho Sugar Company, Idaho Falls, on the factory farm; planted May 1, 1903; from original Kleinwanzlebener seed, which was grown by the Utah Sugar Company in 1902 on their factory farm at Lehi, Utah: Patch of 100 acres; estimated yield, 20 tons per acre. Sampled September 12, 1903. Number of beets, 3. Average weight, $2\frac{1}{8}$ pounds. Brix degrees, 17.42; sugar in juice, 14.30 per cent; purity coefficient, 82.09.

Sugar beets grown by James T. B. Mason on Egin Bench, Fremont County, for Idaho Sugar Company; planted May 6, 1903; seed, original Kleinwanzlebener: Patch of 70 acres; estimated yield, 20 tons per acre. Sampled September 14, 1903. Number of beets, 3. Average weight, 1 pound. Brix degrees, 16.76; sugar in juice, 13.4 per cent; purity coefficient, 84.8.

Sugar beets grown by Austin Brothers, near Rexburg, Idaho, for Idaho Sugar Company; planted May 12, 1903; seed, original Kleinwanzlebener: Patch of 50 acres; estimated yield, 22 tons per acre. Sampled September 14, 1903. Number of beets, 3. Average weight, $1\frac{1}{2}$ pounds. Brix degrees, 16.21; sugar in juice, 13.8 per cent; purity coefficient, 85.7.

Sugar beets grown by A. T. Lawrence at Shelly, Bingham County, Idaho, for Idaho Sugar Company; planted May 5, 1903; from original Kleinwanzlebener seed: Patch of 20 acres; estimated yield, 20 tons per acre. Sampled September 11, 1903. Number of beets, 4. Average weight, $1\frac{3}{4}$ pounds. Brix degrees, 18.69; sugar in juice, 16.40 per cent; purity coefficient, 87.74.

Mountain Home.—The Great Western Beet Sugar Company at this place has filed for record its incorporation papers. It represents a capitalization of \$1,000,000. Formerly the Idaho Beet Sugar Company made an effort to capitalize and establish a factory here. At that time thorough tests were made of the resources of the district. The new company was formed to absorb the holdings and the interests of the former, and is starting into the field with good prospects of establishing a factory here.

IOWA.

The beet-sugar industry for the last eight years has been a theme of constant agitation in different parts of Iowa. The conditions of the State for growing sugar beets and producing sugar have been pretty thoroughly settled in the affirmative. It is in the midst of a large consuming district. It has facilities for transporting both the crude material and the finished product. It has extensive supplies of cheap fuel. It has a good record for production of a great variety of agricultural crops. It is a great State for live stock and the products of the creamery. It is probably the best-equipped State in the Union for the consumption of the feed by-products of a sugar factory. It has considerable local capital. Good agricultural methods in farming are used. It has all the natural conditions that appeal to the managers of a sugar factory. It lacks the one thing necessary, and that is the combined interest and enthusiasm of the farmers. There is an apathy on their part, and a hesitancy to go into a new and untried field, requiring tedious work and large drafts on labor.

The farmers of the State have experienced during the past few years a great change in the status of labor. There has been a constant decrease in the supply and a rise in the wages. They succeed with a large list of agricultural products. They are not confronted with the necessity of something to do, as are the farmers in some States in which the sugar industry is being established. Probably there is no other State that has received a more complete and thorough investigation as to its resources for sugar production. Through such investigation a number of communities have been stimulated to special inquiry and effort, with a view to securing factories. At Mason City, Clear

Lake, Waterloo, Fort Dodge, Storm Lake, Cedar Falls, Missouri Valley, Sioux City, Davenport, Clinton, Algona, and Des Moines the question of establishing a beet-sugar factory has been more or less under discussion. There is no doubt, all things considered, that any of these places would prove a favorable point for the production of sugar beets and the establishment of a factory. Each possess abundant shipping facilities to every part of the State and to adjoining States. Many of them are located on the finest streams of pure water, or on lakes, and have suitable fuel at their doors.

Local capitalists and business men are usually favorably inclined toward the sugar industry at these places. The farmers, as a rule, are not seeking the responsibility of adding the laborious, though profitable, task of beet raising to their already large list of productions.

Among the other places mentioned prominently in relation to proposed factories, are Wheatland, Atlantic, Fruitland, and Avoca. Many things can be said of these places as favorable as of those mentioned above. There are still other places in the State that could be added to the list.

KANSAS.

This State took an active part in the original experimental work for testing its conditions for installing the beet-sugar industry. These experiments were conducted quite generally over the eastern half of the State, particularly in what is known as the corn zone, where agricultural conditions were best known and developed. The experiment station continued these experiments for four or five years, and finally came to the general conclusion that the State was not adapted to profitable sugar-beet growing.

After the successful growing of sugar beets in the southeastern part of Colorado, in the Arkansas Valley, it was determined to renew the experiments in western Kansas, which has the same general conditions. This time the experiments were in the more arid and newer portions of the State, in the section drained by the Arkansas River. The results were especially favorable. It is thought that conditions in western Kansas are quite similar to those around Rocky Ford and Sugar City, in eastern Colorado, where beets are the main farm crop. In these experiments in Kansas, the Arkansas River was followed as far east as Arkansas City.

Experiments have also been renewed in the eastern part of the State. These have resulted in amended conclusions to the effect that Kansas conditions are better for the beet-sugar industry than at first supposed. So strong has this impression become that it is attracting the attention of eastern and western capitalists. In Kearney, Finney, and Hamilton counties, along the line of the Arkansas River and in the southwestern

part of the State, sugar-beet growing has increased very rapidly. Last year several hundred acres were planted to beets.

The following places in the State have been quite active in an experimental way and are negotiating with capitalists for the establishment of sugar factories in the near future: Emporia, Atchison, Hutchinson, Great Bend, Arkansas City, and Independence. Each of these towns has a local organization which is growing sugar beets experimentally. In Hamilton, Kearny, and Finney counties beets have been grown as a farm crop, the beets having been disposed of to the factory at Rocky Ford, in the eastern part of Colorado.

A company was organized last summer, known as the Arkansas Valley Beet-Sugar Land Irrigation Company, with a capital stock of \$270,000, with headquarters at Garden City, in Finney County. It is the purpose of this company in organizing to build a large irrigation ditch, utilizing the water for the purpose of growing beets. It is also claimed that the American Beet-Sugar Company has agreed to build a large factory in this district as soon as the farmers shall have shown the ability and disposition to furnish the factory an assured supply of beets. The centers of beet-sugar growing in these counties are around Syracuse, in Hamilton County, and Garden City, in Finney County.

Hon. F. D. Coburn, a statistician and writer in the interests of agriculture, in the report of the Kansas State Board of Agriculture, of which he is secretary, has the following to say:

In 1902 eighty-five persons in Kearny and Finney counties, Kans., entered into contract with the American Beet Sugar Company, of Rocky Ford, Colo., to grow beets, and in all planted 465 acres. Of the total number of contracting growers, ten, who had planted 26 acres, either abandoned their crops or kept them for stock feed and failed to deliver any beets to the company. Of the remaining 439 acres, 55½ acres, belonging to twelve growers, produced but 191,200 pounds, averaging 3,445 pounds per acre, while 40 acres, belonging to six growers, yielded 1,872,000 pounds, or an average rate of 46,810 pounds per acre. The average yield per acre for the entire 439 acres was 19,365 pounds. Eliminating the 55½ acres upon which the yield was but 191,200 pounds, more than half of that area having been abandoned, the average yield for the remaining 383½ acres was 21,679 pounds per acre, which may be taken as a fair average yield on good soil under intelligent treatment and ordinary conditions in the same vicinity. The beginning of the season of 1902 was backward, and cold north winds, continuing far into the month of May, blighted the young leaves and in some places killed the plants. In adjacent territory, north of Laking and Deerfield, where the bulk of the crop is raised, irrigation is depended upon for moisture in raising most crops. Here the beet ground was irrigated before plowing in March. Then, as soon as practicable, it was plowed and dragged, and the seed, at the rate of 20 pounds to the acre, was planted with a drill about the middle of April. The ground being moist, the seed germinated promptly and a good stand was secured. The beets received their first irrigation about the middle of July and another irrigation about the last of August, these being the periods when water could be secured from the Arkansas River for that purpose. The crop was but little damaged by insects, the cold spring not being conducive to their development or early depredations.

The claim that at least some portions of Kansas are well adapted to the profitable growing of sugar beets for sugar making seems to be verified in the last two years' experience, and those who in the three western Arkansas River Valley counties—Finney, Kearney, and Hamilton—in that time undertook their raising for that purpose. Theoretically and by popular supposition, Kansas has been placed just beyond the boundaries of the sugar-beet belt, but actual practice demonstrates that beets of excellent quality can be raised within her borders.

If circumstances and conditions properly adjust themselves so as to make possible a larger tonnage the area in Kansas devoted to the culture of sugar beets will doubtless be expanded and increased beyond the expectation of the most sanguine, and the industry will become an important factor in Kansas agriculture. Considering their inexperience, insufficient and unsuitable equipment, the results of 15 growers in Kansas in 1901 was most gratifying and significant, their average profit per acre being reported as \$28.48, while the highest individual profit per acre was \$43. The possibilities in this direction are well suggested by the fact that in 1901 77 growers harvested 337 acres, which yielded in the aggregate 1,747 tons, or an average yield per acre of 5.10 tons. In 1902, 75 growers from 439 acres harvested 4,250 tons, or an average of 9.68 per acre, an increase in average yield per acre in one year of 90 per cent. The general average per cent of sugar in the beets in 1901 was 17.80, while the average in Germany, the great sugar country of the world, was reported as about 15 and in all Europe about 13½ to 14 per cent.

As deduced from the data in the office of the State board of agriculture, the general average per cent of sugar in beets in 1902 was 17.64. Where such handsome profits per acre are secured from the first year's trial it would seem that the industry is one which is at least entitled to, and should be given, cordial encouragement and generous recognition in order that it may be definitely determined whether sugar beets may not be well adapted to a large portion of the State, and be profitably grown here for sugar making.

Emporia.—Emporia, Kans., has also been energetic in testing its farming vicinity as to the conditions for sugar-beet growing. I give herewith a report made by Eli Fowler, of that place, relating to the experiments during the past year.

DECEMBER 31, 1903.

DEAR SIR: Replying to your favor of the 19th, regarding the test being made by our sugar beet association, of which I am president, I herewith inclose a copy of the last test, which was made by the factory at Rocky Ford. This is quite the best test of any which we sent, and we think this was due to the fact that the beets were more nearly mature when harvested. They were harvested early in November. I desire to call your attention to the fact that the season just passed has been a very wet one, and the spring was very late and the conditions in general were unfavorable to a fair test; and, furthermore, our farmers were wholly unused to beet raising, and it was more a matter of guesswork than anything else with them. We believe that with more experience and a more favorable season, which would give the beets time to ripen, our beets would test from 3 to 4 per cent better than they did this year. One of our producers tested for productiveness and found that he had produced about 26 tons per acre of beets. Of course, our climatic conditions are such that no irrigation is necessary. We have plenty of rainfall to mature sugar beets or any other crop. As yet we have no definite proposition for the location of a factory, but we have been sending our reports to different parties interested along this line.

We intend to repeat the experiment next season; and I would like very much for you to furnish me, for the use of the association, copies of such documents and reports as you have on hand pertaining to sugar-beet culture, in order that we may

compare our showing with the experiments from other localities, and we would also like copies of your report, when the same is issued, as well as any other information you can give us along this line. If there is any further information you desire in regard to our test, please feel at liberty to command me.

Very truly,

ELI FOWLER.

ROCKY FORD, COLO., December 15, 1903.

DEAR SIR: Below you will find an analysis of last beet samples sent by you:

Analyses of beets grown in Lyon County, Kans., 1903.

Name and address of grower.	Per cent of sugar in beet.	Coefficient of purity.
Eli Fowler, Emporia.....	16.2	86.1
Chas. D. Burdick, Emporia.....	13.9	76.6
J. M. Wellman, Emporia.....	9.9	64.7
H. J. Painter, Emporia.....	15.4	78.1
S. T. Bennett, Plymouth.....	11.5	70.3
Do.....	11.9	79.5
Wm. Bishop, Emporia.....	11.0	73.5
J. H. Howe & Son, Emporia.....	15.9	81.5
Rufus Fowler, Emporia.....	12.9	79.0
Peters Hardware Co., Emporia.....	15.2	84.8
Walker & Walker, Plymouth.....	14.0	70.1
W. S. Williamson, Emporia.....	16.4	82.0
Fred Gunkel, Emporia.....	11.5	77.0

Yours, truly,

C. F. EVANS.

ELI FOWLER, Esq., Emporia, Kans.

Arkansas City.—Below is given a report made by G. Luther Brown, of Arkansas City, on the results of beet growing in the neighborhood of that place during the past year. For experimental work the showing is very good. It is a well-known fact, shown in the history of all experimental tests in beet growing, that practical results after the establishment of a factory are a great deal better than those of the original experiments. The report follows:

ARKANSAS CITY, KANS., January 2, 1904.

DEAR SIR: Your letter of December 19 to J. Mack Love, of this city, concerning our sugar-beet experiments during the season of 1903 was handed me to answer. I inclose herewith copies of the report showing the results of analyses, also the dates of the analyses. We went into the experiment rather late in the season, and, taking all things into consideration, we think we have made a good showing. Our season was peculiar, being very wet in the spring and again wet in the fall at pulling time.

We had dry weather in August, and the first beets pulled and sent out for testing made a better showing as to sugar content than did the later ones, owing to the fact that we had a very wet spell in September, which caused the beets to make a second growth. We expect to make experiments again another year on a larger scale, and we are meeting with encouragement from several sources that a sugar mill will locate here if we demonstrate that our climate and soil are reliable by raising beets two years in succession. Our best results this year were from upland and valley land, the bottom-land beets showing the poorest quality.

Most of our experiments were made on a small scale in gardens and corners of fields, but the best results were from good-sized patches grown in the center of old culti-

vated fields. One man in Oklahoma, 9 miles south of our city, raised 1 acre and took off some 27 tons of beets, his land being what is classed as valley upland. He is now an enthusiast on the subject and will grow another acre next year. He fed beets for five months to his stock, and would be feeding yet if his crop was not exhausted. Any further information will be cheerfully given you. We think we are in the belt of country where beets can be grown successfully without irrigation, and we are quite confident of landing a sugar mill.

Yours, truly,

G. LUTHER BROWN.

Analyses of beets grown at or near Arkansas City, Kans., 1903.

Name and address of grower.	Date of analysis.	Per cent of sugar.	Purity coefficient.
H. M. Griffith, Arkansas City, Kans.	Oct. 5	15.0	82.0
A. J. Arnett, Arkansas City, Kans.	do	14.1	76.2
E. C. Crampton, Arkansas City, Kans.	do	17.1	83.8
Homer Coulter, Arkansas City, Kans.	do	11.7	72.2
J. C. Casaday, Arkansas City, Kans.	do	13.7	71.8
J. N. Crutchfield, Arkansas City, Kans.	do	12.2	71.8
Geo. Allen, Arkansas City, Kans.	do	13.3	71.2
F. M. Shirley, Arkansas City, Kans.	do	12.7	74.7
F. L. Baxter, Arkansas City, Kans.	do	13.1	74.0
Ruth Wright, Arkansas City, Kans.	do	15.0	77.7
— Hanson, Arkansas City, Kans.	do	13.3	75.0
B. Brewer, Arkansas City, Kans.	do	14.2	75.9
I. N. Haggard, Arkansas City, Kans.	do	14.5	80.5
A. H. Abrams, Arkansas City, Kans.	do	16.3	78.8
Alvin Goff, Arkansas City, Kans.	do	13.5	79.4
J. R. Granger, Arkansas City, Kans.	do	15.4	86.5
Wm. Metzler, Arkansas City, Kans.	do	13.8	76.8
Rudolph Hess, Arkansas City, Kans.	do	12.6	70.0
A. B. Rigg, Arkansas City, Kans.	do	12.7	75.2
John Myrtle, Arkansas City, Kans.	do	15.7	78.5
I. M. Vickery, Arkansas City, Kans.	do	11.5	70.0
T. B. Marshall, Arkansas City, Kans.	do	15.5	82.0
S. W. Mayhill, Arkansas City, Kans.	do	17.4	82.1
F. Trimper, Arkansas City, Kans.	do	12.0	74.5
W. F. Mansfield, Arkansas City, Kans.	do	12.3	70.3
A. B. McCutchen, Arkansas City, Kans.	do	13.6	70.9
Jas. H. Penton, Arkansas City, Kans.	do	15.1	77.4
J. S. Pickett, Ashton, Kans.	do	15.6	71.2
I. Burger, Portland, Kans.	do	16.6	72.2
W. J. Lane, Gueda Springs, Kans.	do	13.3	74.0
Bert Houston, Middleton, Okla.	do	15.3	84.1
C. C. Waltz, Windfield, Kans.	do	12.0	73.0
Marion Worford, Arkansas City, Kans.	do	14.4	77.5
Sam Mempe, Arkansas City, Kans.	do	14.4	77.3
A. B. Abrams, Arkansas City, Kans.	do	13.8	78.4
H. H. Cochran, Arkansas City, Kans.	do	13.8	76.5
A. C. McCutchen, Arkansas City, Kans.	do	13.8	75.7
F. Kemper, Arkansas City, Kans.	do	13.7	76.0
A. Goff, Arkansas City, Kans.	do	13.5	78.4
E. C. Crampton, Arkansas City, Kans.	do	13.5	77.6
Sam Gamble, Arkansas City, Kans.	do	13.5	74.2
H. M. Griffith, Arkansas City, Kans.	do	13.4	78.7
F. L. Baxter, Arkansas City, Kans.	do	13.4	76.7
S. W. Mayhill, Arkansas City, Kans.	do	13.3	74.9
P. B. Andrews, Arkansas City, Kans.	do	13.2	80.2
G. A. Dodds, Arkansas City, Kans.	do	13.2	76.8
J. W. Chambers, Arkansas City, Kans.	do	13.2	73.0
Rudolph Hess, Arkansas City, Kans.	do	13.1	78.0
Jas. H. Penton, Arkansas City, Kans.	do	12.6	78.9
S. G. Phillips, Arkansas City, Kans.	do	12.2	77.6
J. S. Harding, Arkansas City, Kans.	do	12.1	77.0
R. Mercer, Arkansas City, Kans.	do	11.9	71.3
J. Cal Fleece, Arkansas City, Kans.	do	11.7	75.1
M. C. Shivers, Arkansas City, Kans.	do	11.6	75.7
H. M. Griffith, Arkansas City, Kans.	Nov. 5	14.2	88.7
A. Goff, Arkansas City, Kans.	do	12.7	80.7
A. H. Abrams, Arkansas City, Kans.	do	12.3	78.3
Reinold Hess, Arkansas City, Kans.	do	12.3	81.2
John Smith, Arkansas City, Kans.	do	11.7	76.4
A. B. Rigg, Arkansas City, Kans.	do	11.6	79.2
Miss Ruth Wright, Arkansas City, Kans.	do	11.0	74.3
A. W. Kavanaugh, Arkansas City, Kans.	do	11.3	73.0
Chas. Seyfer, Arkansas City, Kans.	do	10.7	70.1
Theo. Moore, Arkansas City, Kans.	do	10.5	76.5
T. F. Brandenburg, Arkansas City, Kans.	do	10.5	72.5

Analyses of beets grown at or near Arkansas City, Kans., 1903—Continued.

Name and address of grower.	Date of analysis.	Per cent of sugar.	Purity coefficient.
E. C. Godfrey, Arkansas City, Kans.....	Nov. 5	10.6	72.2
Mrs. E. C. Bossie, Arkansas City, Kans.....	do	10.3	72.5
Homer Coulter, Arkansas City, Kans.....	do	10.2	69.8
R. F. Demott, Peckham, Okla.....	Nov. 26	15.4	84.8
P. B. Anderson, Arkansas City, Kans.....	do	14.2	83.3
E. C. Crampton, Arkansas City, Kans.....	do	14.1	83.1
I. Burger, Portland, Kans.....	do	13.0	79.2
J. S. Pickett, Portland, Kans.....	do	12.9	79.5
F. P. Thomas, Arkansas City, Kans.....	do	12.8	81.4
John Myrtle, Arkansas City, Kans.....	do	12.7	79.8
W. J. Lane, Gueda Springs, Kans.....	do	12.4	76.2
Thomas Baird, Arkansas City, Kans.....	do	12.4	78.9
W. J. Stewart, Arkansas City, Kans.....	do	11.5	75.6
C. F. Hanson, Arkansas City, Kans.....	do	11.6	76.3
W. A. Lyster, Arkansas City, Kans.....	do	13.2	80.8
A. B. McCutcheon, Arkansas City, Kans.....	do	11.4	73.2
Mrs. E. DeMott, Oklahoma.....	do	12.2	75.8
F. B. Marshall, Arkansas City, Kans.....	do	12.0	75.9
S. G. Phillips, Arkansas City, Kans.....	do	11.7	76.4
Wm. Metzler, Arkansas City, Kans.....	do	11.9	77.7
John Wilhelm, Arkansas City, Kans.....	do	11.2	70.0
I. M. Emely, Arkansas City, Kans.....	do	11.0	75.3
Miss Ruth Wright, Arkansas City, Kans.....	do	11.0	74.3
B. Brewer, Arkansas City, Kans.....	do	10.6	74.7
F. L. Baxter, Arkansas City, Kans.....	do	10.4	73.0
E. C. Bivens, Arkansas City, Kans.....	do	10.9	72.8

MONTANA.

There are several places in Montana that have been thoroughly tested for the production of sugar beets. The State experiment station has done considerable work in this direction. From time to time the establishment of beet-sugar factories at different points in the State has been proposed and discussed. During the past summer there have been negotiations with this end in view between local interests and outside capital at the following places:

Chinook.—Chinook, Mont., has been active in negotiations with capitalists for some time past. There are good indications of the establishment of a sugar factory at this place in the near future.

Conrad.—At Conrad the Conrad Investment Company, owning a large body of land, has been investigating the propriety of building a beet-sugar factory to utilize its land and enhance its value. It contemplates carrying on a large cattle-feeding enterprise along with the beet-sugar industry, realizing that this would give a market for the pulp, and the two enterprises would be mutually beneficial.

Fort Assinniboine.—This place has also been actively considering the sugar industry, and it is claimed that the town has very good prospects of securing a factory.

MICHIGAN.

Michigan has been the storm center of the development of the beet-sugar industry for years. It had 22 factories in active operation in the campaign of 1904, and there are prospects for quite a number of

new factories in the near future. This State has thoroughly exploded the idea that northern latitudes operate to the detriment of beet-sugar enterprises. Experiments of the State experiment station indicate that the farther north in Michigan the higher the sugar content and purity of the beets. The State has already one successful factory in the northern peninsula, and several others are contemplated.

In other reports I have given the many advantages of this State for producing beet sugar, chief among which were its facilities for transportation by water and railroad. Experience is confirming my former statements. It is found that the rivers and lake shores offer facilities for cheap shipping of beets and crude material to the factory. The transportation facilities of the State are certainly ideal. Here local advantages do much to overcome the advantage of superior quality of the beets grown in some other sections of the United States.

The value of by-products is beginning to be seriously appreciated in this State. There is a large chemical company manufacturing alcohol from the refuse molasses, consuming the entire output of many sugar factories. Records of the Treasury Department show that this company has paid large revenues, indicating that the production of alcohol is considerable. Vinegar works are also being established for the production of this product from the waste molasses.

Extensive feeding experiments are being carried on to ascertain the value of pulp as a ration for stock feeding. The feeders are beginning to appreciate more and more the value of this by-product. Eventually it is going to have a wonderful influence upon the stock interests of the State. These factories appeared suddenly, producing hundreds of thousands of tons of feed, while the increase of stock growing and appreciation of pulp feeding were naturally of slow growth. It will take time for consumption of pulp to catch up with production. This has resulted in the waste of a large amount of it. But Michigan, like the older countries of Europe, will eventually either find use at home for every pound of pulp produced by the factories, no matter how many, or, after drying and preserving it, will ship it to profitable markets in other States. Working out the destinies of a great industry like the beet-sugar industry requires time. In drying the pulp the citizens of Michigan are taking the lead, working it up and producing a high class of stock feed, greatly reducing its weight and very materially increasing the percentage of nutritive elements. This makes it available for shipping and storing like other kinds of stock feed, such as bran, flaxseed meal, and the like. In European countries none of the pulp is wasted. It is a staple commodity, and everybody who possesses an animal is a consumer of pulp, either in the dry form or the wet form direct from the factory. This will be the case in Michigan when the farming and feeding interests of the State shall have had time to catch up with the rapid progress of the sugar industry

One of the noticeable things about the sugar industry in Michigan is the tendency of the several factories to attract capital for additional factory building in the State of Michigan, in Canada, or in the States farther west. This is one of the healthful signs of the sugar industry. Not only are these capitalists interesting themselves directly in the sugar industry, but they are organizing subsidiary companies for working up the by-products into other commodities. During the past summer in the public press considerable attention has been given to a process which is as yet secret, but known to a number of eastern and Michigan capitalists who contemplate manufacturing from the molasses and beet pulp several products not hitherto produced in connection with this industry. It is claimed by those interested in this process that every ingredient of molasses and pulp can be worked out into a product of commercial value. Pulp can be made to produce alcohol, glue, charcoal, and other things, and waste molasses is equally resourceful. There is no doubt that, as the sugar industry develops, many of these things that are now vague suggestions will work out into actual realities. The evolution of the beet-sugar industry is like that of the meat industry, which, in the light of the present procedure, was carried on in a most wasteful manner a few years ago. The meat supply of a city was prepared locally, in many ways, and from many sources. A large part of the animal was a total loss. But gradually the meat industry was centralized and organized in the United States until now every part of the animal is saved; there is practically no waste; the hair, hoofs, blood, horns, and, in fact, every part of the body is utilized in the formation of one or several commercial commodities. It is quite probable that the beet-sugar industry will develop in the same way. We can see it slowly but gradually working out the details of development. The use of by-products is one of the factors in the contest in all parts of the world between cane and beets as sources of sugar. This is a contest between the Temperate Zone, with its science and civilization, and the Tropics, with nature's abundance, and cheap but poor labor, and no by-products.

There has been considerable interest in the location of additional factories in Michigan during the past year at the following places:

Scottsville.—This town is located in the county of Mason, about equally distant between the north and south ends of the southern peninsula, and borders Lake Michigan. It is said to have good sugar-beet territory. It certainly has excellent facilities for lake shipping. It has been growing sugar beets during the last summer under a trial test, and is under negotiation with capitalists for the establishment of a factory.

Kalkaska.—This place has been negotiating with parties desiring to establish a beet-sugar factory, and is in the field arranging for con-

tracts sufficient to secure the factory. It is about three-fourths the distance north in the southern peninsula, and the center of that territory east and west.

Ishpeming.—The Beet Sugar Gazette, of Chicago, Ill., states that the Cleveland Cliffs Iron Company intends to build a beet-sugar factory in this section, where it owns large tracts of land.

Traverse City.—This is a lively town in the northwestern part of the lower peninsula, on the west arm of Grand Traverse Bay, a part of Lake Michigan. It is not very far from the factory at Charlevoix, and is across the lake from the one at Menominee, in the upper peninsula. This place has done considerable in the direction of securing a sugar factory. The business men have an organization, and the farmers have a growers' association. The two have had several meetings, and the situation has been pretty thoroughly canvassed.

This is an extensive potato-growing district. The people have become wedded to the enterprise. Quite a number of farmers in the locality, however, have been growing beets the past summer for the two factories mentioned. Propositions have been made by interested parties that a sugar factory will be built when sufficient acreage can be procured to maintain a sugar factory. This place also has the advantage of lake shipping for the crude and finished products. Although produced in an unfavorable year, the beets grown here last year were among the best in quality in the State. The average tonnage was about equal to that of the United States. This is a good showing under the circumstances.

Below is given a report from W. W. Smith, of this place, relating to the results of sugar-beet growing in that vicinity during the past summer:

TRAVERSE CITY, MICH., *December 28, 1903.*

DEAR SIR: Yours of December 21 was handed me for reply. Between 1,000 and 2,000 tons of beets were raised in this county; \$4.60 and \$5 were paid to farmers per ton f. o. b. cars here, flat rate. Our beets showed an average of 16 per cent sugar. We do not irrigate; in fact, we had a little too much natural irrigation last summer. We tried to get the farmers to take hold of the beet business, as we were told if we could get 5,000 acres contracted we could get a factory next year. This is a great potato country, with good yield and good average prices, so that farmers were loath to take hold of something new to them. It was a bad year for beets, cold and wet, and those who did try them did not have very good results. The yield ran from 6 to 12 tons per acre, with an average of about 9. I do not think very many will try them again soon. Of course if we had a factory here we could do better, as there would be about a dollar more—the difference in freight—per ton to the farmer, who would be more likely to take hold of them.

We are looking up the matter of getting a factory here, if possible, and, if successful, I think we can get the farmers interested again. The per cent of sugar in beets raised here is the highest in the State.

Very truly, yours,

W. W. SMITH.

Flint.—Recently the business and farm interests at Flint have received a proposition for establishing a beet-sugar factory at this

place, providing sufficient acreage can be procured to supply a factory. An organization was effected among local interests and the matter is under active negotiations, with the prospect that a factory may be located here in the near future.

Cheboygan.—Capitalists of Detroit have been testing the conditions around Cheboygan with a view to locating a beet factory. This county is the northernmost point of the southern peninsula, and borders the water of Lake Michigan and Lake Huron at their junction. Those locally interested have received a proposition that a factory costing \$600,000, having a capacity of 600 tons a day, will be built at this place, provided those locally interested will take \$150,000 of the stock, furnish the factory a site of 40 to 50 acres on the lake front, and procure contracts for sufficient beets to operate the factory.

Sault Ste. Marie.—For some time there has been public rumor and considerable local activity regarding the establishment of a beet-sugar factory at this place. It is located on the channel connecting Lake Huron and Lake Superior in Chippewa County. Beets have been grown here experimentally, and they have proved of good quality and purity. It is reported that the Cleveland Cliffs Iron Company recently acquired ownership of all the land of the Peninsula Company, which were extensive in this section, and that it proposes establishing a beet-sugar factory at this place and bringing these lands into use.

MINNESOTA.

For a series of years the experiment station of this State conducted many experiments in various parts of Minnesota. It was found generally that the lands possessed good qualifications for beet production. It is a State devoted to general farming, and is quite productive in almost everything adapted to its climate and conditions. About four years ago a factory was established at St. Louis Park, Minn. It has been operated ever since.

In former reports I have pointed out the strenuous competition this factory met in other crops in the State. It is one of the best illustrations in the history of the beet-sugar industry in the United States of the trials and obstacles a factory must meet in a naturally good sugar-beet territory. Farmers were slow to take up with this unknown and "hard-work" branch of farming. Its progress was gradual, but it finally won its way with the better class of farmers, who, like other business men, based their conclusions on results. It was claimed at first that it cost too much to grow the beets. Thirty dollars an acre was too much money for growing a crop. The net profit side of the argument, after two or three years' experience, was one that finally appealed to the farmers of the State. It was found that a farmer would pay out considerable money on a 10 or 20 acre tract, but the

proceeds were also large in comparison with those of any other crop and the net profits were considerably larger in proportion. It was also found that sugar beets could stand a drought better and a deluge better. In 1891, on account of drought, most of the crops of the State were very light, running from 50 per cent down to failure. Sugar beets were an average crop. This was followed the next year with excessive rains, producing as bad results with ordinary crops as the year before, while the crop of sugar beets was good. This factory had been compelled in procuring its contracts for beets to cover a large part of the cultivated portions of the State; also to go down 100 to 150 miles into Iowa. Gradually the management was enabled to withdraw from the more distant and undesirable portions of its beet-growing districts and select those localities more favorable for its work in its own State.

There are several places in Minnesota where beet growing is successful, where the establishment of factories is under consideration.

Faribault.—This town is in Rice County, in the southeastern part of the State, and on two railroads. It is only one county removed from the location of the factory at St. Louis Park. The farmers have had considerable experience in growing sugar beets for that factory. It is one of the best farming districts in the State. The location is one well adapted for the utilization of by-products and for the shipment of crude materials and the finished product. The Commercial Club of the city is making energetic efforts for the establishment of a factory. The following report was received from W. W. Steakly, of this place:

FARIBAULT, MINN., *January 12, 1904.*

DEAR SIR: Your esteemed favor of recent date, containing certain inquiries concerning the beet-sugar industry in Rice County, Minn., is at hand. I will gladly give you all the information at my command, but wish to say that while I have taken great interest in, and made a careful study of, sugar-beet culture, I have only for the past two seasons devoted my time to this branch of agriculture. I have during this time raised beets myself, as well as acted as local agent for the Minnesota Sugar Company at St. Louis Park. In my capacity as local agent I can give you a correct answer as to the number of acres of beets raised in this county, prices paid, and cost of production, but I am unable to give you the chemical data, secured by analysis at the factory, except what information I received in a conversational way with the manager of the above factory.

I was told that the beets raised in 1902 and 1903 for that factory contained on an average 16 per cent of sugar—varying from 14 to 18 per cent and higher—with an average purity of from 82 to 92.

In 1902 there were 56 acres of beets harvested in Rice County. The net weight of the beets was 1,388,000 pounds, or 694 tons, giving an average of nearly 13 tons per acre. In one instance 46 tons were raised on 2 acres. The price paid by the Minnesota Sugar Company, to whom the beets were sold, was \$4.50 for the ton, of 2,000 pounds net. Besides this the company paid toward the freight (which amounted to 70 cents from here to St. Louis Park) 35 cents, leaving for the farmer, after deduction for freight, \$4.15 per ton for beets. In 1902 there were shipped from here 694 tons, grown on 56 acres; in 1903, from Rice County, in all, 1,442 tons, grown on 117 acres,

an average of about 12 tons per acre. The heavy rains during the summer greatly damaged many beet fields, otherwise the results would have been more favorable. The cost of production does not, according to my estimation, exceed over \$30 per acre; in some instances it was less, and in some more, depending largely on the care taken in preparing the seed bed, thinning, and cultivating at the right time. In order to show the net profits per acre, I wish to say that, as above stated, the farmer gets \$4.15 per ton, laid down at the factory, but he has to pay for his seed and the use of tools, which are both furnished him by the beet company, leaving him in the neighborhood of \$4 net for his beets.

Below I will give you a list of farmers, their acreage, the amounts received after deducting for seed, freight, and use of machinery.

Results of growing sugar beets in Rice County, Minn.

Name of grower.	Acres in beets.	Net returns.
Jens Christenson.....	2	\$129.68
Emil Deroo.....	2	121.98
B. Emge.....	2	83.98
J. P. Graham.....	2	90.28
Aug. Kath.....	2	123.54
A. Vancelous.....	2	184.82
H. E. Eastling.....	2	98.24
Albert Kern.....	7	352.42
John Lonien.....	2	108.73
Theo. Pufahl.....	2	94.65

The amounts above given, which represent average crops, do not, however, by any means give a correct idea of the yield and absolute returns per acre, as any number of farmers, if not all, retained a certain quantity of their beets to feed their cattle.

Many of our prominent and influential citizens are very much in favor of establishing a factory at this point, since the primary requirements—beets, good shipping facilities, pure water, coal at reasonable prices, limestone quarries—are here (while the Minnesota Sugar Company has to ship from here), making this an ideal location. In fact, some eastern parties are negotiating a factory here.

In closing I wish to say that the yield of beets per acre could be greatly increased if the farmers would only heed the advice given them as to proper cultivation of beets. It seems that no amount of talking and explaining will do any good. It seems to me that the Government or the owners of beet-sugar factories, who do not hesitate to invest large sums in their plants, would establish experimental patches of beets throughout the beet-growing districts in order to demonstrate to the farmers how much careful work will diminish the amount of labor required to produce beets and at the same time enhance the tonnage of beets per acre.

I beg to remain, very respectfully, yours,

W. W. STEAKLY,

Local Agent Minnesota Sugar Company.

Duluth.—Parties in Michigan and those interested in the Wisconsin Sugar Company, at Menomonee Falls, Wis., have been examining the conditions and qualifications of Duluth as a point for establishing a sugar factory. The Commercial Club of this city has been agitating the question, and appointed a committee to talk with the farmers with a view to securing sufficient acreage to operate a factory at this point.

Duluth is in St. Louis County, in the northeastern part of Minnesota, at the western extremity of Lake Superior, and is the great commercial center of that region for the shipment of western grains

and ores. It possesses many manufacturing interests and has many qualifications for establishing the beet-sugar industry.

INDIANA.

In the State of Indiana growing sugar beets has received considerable attention experimentally. Doctor Wiley, of the Bureau of Chemistry, investigated many parts of this State in his early researches. Since then the experiment station has investigated many portions of the State. Capitalists and others interested in establishing sugar factories have grown and tested beets. In many ways its availability for the beet-sugar industry has been tested.

It has been quite conclusively shown that the upper half of the State is well adapted to sugar-beet growing and sugar manufacturing. It is ideal in its market facilities. The State is crossed by railroads running in every direction, facilitating shipments. It has developed extensive manufacturing interests, has abundance of coal, and in fact everything needed to maintain the sugar industry. Experience in growing sugar beets in the State is not entirely confined to experiments. The factories in the southern part of Michigan drew upon this State for large supplies of beets.

The factory at Kalamazoo, Mich., contracted for considerable acreage at a small place called Hammond, Ind., near Chicago. Beets have been grown at this place for the past two years. There is a large district in this vicinity having the same kind of soil, and growers have found that the beets do well and that they are a paying crop. There has been considerable talk on the part of capitalists about establishing a factory at this place. It has a very good prospect for securing one in the future. Its proximity to so large a commercial center would make this place a very desirable one. There are many places in the northern part of the State where plans have nearly materialized for establishing factories. Among these are Fort Wayne, South Bend, Shelby, Elkhart, and Logansport. Other places receiving special attention during 1903 are Terre Haute, Andrews, Lawrenceburg, and several others. These places have prospects of securing capital, contingent upon the results in growing the beets and the attitude of the farmers in regard to furnishing a sufficient supply.

ILLINOIS.

Probably no other State in the Union through its State experiment station has investigated its conditions for the beet-sugar industry as extensively as this State. As in all agricultural States of the middle portion of the United States, it is retarded by the apathy of the farmer in regard to taking up beet growing. I find that the in newer portions of the West, where agricultural conditions are less understood

and where the necessity to do something is greater, there is a greater tendency to new projects, especially to sugar production. In the East hesitation is inspired by the strong competition which well-established crops give newer ones. Land values are already high, based on the actual results with well-established crops. Out West there is an incentive to produce something that will create higher land values. When a person moves into a new country he has not the assurance that comes from a well-established order of things. Conditions must be tried. He becomes at once an investigator; contracts with farmers are more easily obtained. With an assured beet crop the sugar factory gets a readier foothold. In the East the factories meet with competition unfavorable to beets, influenced by conservatism; in the West it is competition in their favor, induced by progress.

It has been found by actual test that the State of Illinois, in its upper half, is eminently fitted for beet growing. With its fuel supply, transportation facilities, and market advantages, it goes without saying that it is fitted for manufacturing. During the past year there has been considerable talk about building a sugar factory in Chicago itself, and drawing on the agricultural country in its near vicinity for its supply of beets. At one time during the past year there was a well-defined plan of interesting the wholesale grocers in building such a factory. A few years ago a beet-sugar factory was established at Pekin, near Peoria, and was run one year. This was a poor crop year, and had the effect of discouraging the farmers to some extent. The factory itself was built in a district which was a large producer of whisky and glucose. Comparisons with these established industries were discouraging both to manufacturers and growers. The factory was dismantled and the machinery turned to other uses. It is nevertheless true that the State has strong advantages both for producing beets and manufacturing sugar. These will some day assert themselves, and Illinois will enter the list of sugar-producing States.

NEBRASKA.

Nebraska is one of the oldest States in beet-sugar making in the United States, having maintained two factories for several years, one at Norfolk and one at Grand Island. About four years ago a factory was built near Ames, about 50 miles west of Omaha, on the Union Pacific. Around Grand Island the soil is a light sandy loam and receives less rainfall than at either of the other places. Around Ames most of the beets are grown on heavy bottom soils composed of rich alluvial deposits and subject to overflows and water saturation by heavy rains. Ames, like Grand Island, is situated near the Platte River. Around the factory at Norfolk, on the Elkhorn River, in Madison County, near the northeastern part of the State, the beets are grown both in the river bottoms and on the uplands, but there is

a stronger variety of soil than at Grand Island. It may be said that the soils at Ames and Norfolk are rated among Nebraska's best corn lands. The conditions around these three factories, however, pretty thoroughly exemplify all the agricultural conditions in the eastern half of the State, so far as concerns climate, fertility, etc. Previous to the past two seasons all talk of extending the sugar industry in this State has been confined to the eastern part of the State, and at a number of places the installation of sugar factories has been seriously proposed. Around Fremont beets are grown for the factory at Ames. Formerly some beets were grown in this locality for the other two factories. It is a junction point for railroads and quite a prosperous little city, and favorably located for a sugar factory.

But the thing which has attracted most attention in relation to sugar-beet growing in Nebraska during the last two years is the interest taken in this subject in the western part of the State. It is likely that the industry will find its future development and extension taking place mainly in the western part. The residents of this part of the State have been quick to see the advantages of sugar-beet growing by irrigation, and are rapidly developing the industry. The main sources of irrigation water in western Nebraska are the North Platte, the South Platte, and the Republican rivers. The main efforts on the Platte River (formed by the union of the North and South Platte), are confined to Lincoln County, one county removed east from the State of Colorado, and to Kearney and Buffalo counties, about the center of the State east and west.

It is estimated that about 4,000 acres of beets were grown in Lincoln County during the past year. These western counties, after ditches were established, began the experiment of growing sugar beets for the factories at Ames and the one at Grand Island. These results were so successful that the farmers rapidly increased their acreage.

North Platte.—For some time there has been quite a concerted movement on the part of the people in the vicinity of North Platte, in Lincoln County, to establish a beet-sugar factory. The high quality of the beets and the encouraging tonnage returns have proven very strong inducements. With their present capacity, 4,000 acres of beets would be highly acceptable to any of the factories now operating in the State of Nebraska. The farming district in the vicinity of North Platte has about 200 miles of ditch, which supplies water for quite a large area of farming lands. It is quite probable that, with the local inducements and propositions from two or three different concerns, a sugar factory will be established at this point in the near future. The following report was made by James Scillee, of North Platte, Nebr., during the past year. Mr. Scillee was formerly superintendent of beet growing for the Standard Cattle Company at Ames, and had

charge for several years of its large sugar-beet acreage, ranging from 1,000 to 1,200 acres. He is now in the employ of the business men and farmers of North Platte, superintending their beet growing. His report is as follows:

1. There were 4,200 acres of beets raised in Lincoln County this year; 2,000 went to the Standard Beet Sugar Company at Ames, Nebr., and 2,000 went to the American Beet Sugar Company, at Norfolk and Grand Island.

2. The price received was \$4 per ton for beets testing 14 per cent sugar or under, and an additional 25 cents per ton for each and every 1 per cent of sugar above 14 per cent, fractions in proportion.

3. We had several loads of beets that tested 25 per cent sugar with a purity of 88. The average of the whole crop would be about 17 per cent sugar. Beets range from 22 tons per acre down to 5 tons per acre. The great variation was caused mostly by hail, and by cold wet weather in the spring which destroyed the seed; also by inexperience of growers.

4. Mr. Louie Tillion, on a 6-acre piece raised 18 tons per acre. He did not keep a record of the expense, but did the work himself. For these beets he received about \$4.70 per ton, or \$84.60 per acre. Out of this he paid \$3 for seed, the balance, \$81.70, he had for his time on beets. A number of others had similar experiences. Ed. Murphy, of Brady, on 10 acres had 14 tons per acre. A. Warnack, of Maxwell, on 10 acres harvested 16 tons per acre. C. Hutchinson, of Maxwell, got 15 tons per acre on 5 acres. F. M. Drake secured a yield of 14 tons per acre on 10 acres. A good many of these had not grown beets before; otherwise the tonnage might have been considerably higher. In connection with this, I would say that other crops, including corn, were almost a total failure, on account of the cold, wet spring and early frosts.

5. We irrigated very extensively from North Platte to Paxton, the valley being about 33 miles long and 5 miles wide. We get water from the North Platte River in our main ditches, of which there are some six or seven. We use irrigating shovels, running the water down the rows, making several cross laterals in a field, wherever it is necessary, in order not to wash the soil, or saturate some parts of the field too much in getting in the water to other parts.

6. The prospects for a factory are good, as the soil and climate are admirably adapted to sugar-beet growing, and as considerable of the land will not grow any other crop on account of being cold and full of alkali. For instance, on one piece of land at Hershey, on Mr. Paxton's place, he has been trying for eleven years to get a crop, without success. He this year asked me to make a test of this piece—28 acres—giving the land already plowed rent free. From this piece of 28 acres we received for beets raised \$1,065, besides the cattle ate up about 25 tons. It is only a matter of getting enough land subdued, and of the county being able to guarantee 5,000 acres of beets for three years when a factory will be built. From the present outlook, it appears to me they will be able to do that this coming year. I believe the conditions here are as good for growing beets as at any place in the United States, and it is only necessary for these facts to become known to bring in experienced growers; and with the experience growers have had this year I look for very much better results another year.

JAMES SCILLEY, *North Platte, Nebr.*

Culbertson and McCook.—Near the south line of the State, about two-thirds of the way west from the eastern extremity of the State, we have two other extensive sugar-beet districts centered around Culbertson, in Hitchcock County, and McCook, in Redwillow County.

About 1,500 acres of beets were planted in the aggregate in these two districts during the past summer. They are both irrigated from the Republican River. These places have been growing beets for the factories mentioned above, and have been as successful in this undertaking as have the growers in Lincoln County. Railroads have been quick to see the advantages offered by these western places in this new industry. At these places and around North Platte several hundred feet of side track have been placed. Weighing facilities and dumps have been arranged. Land values in Lincoln, Hitchcock, and Redwillow counties have gradually increased under the favorable showing of the sugar-beet crop during the past two seasons. Both Culbertson and McCook interests are negotiating with the Standard Beet Sugar Company, of Ames, and the American Beet Sugar Company, of Grand Island, with a view to building factories at these places.

There are quite a number of plans on foot in addition to these. The beets grown in these counties have been of a high grade, and the tonnage has been satisfactory in comparison with other crops grown in that district. The farmers show every readiness to grow the beets. Taking into consideration the quality and sugar content, it is highly probable that sugar manufacturers will not overlook these advantages and that we shall have in 1904 or in the near future factories at all three of the places above named.

OHIO.

There has been considerable talk of reviving the beet-sugar industry in the State of Ohio. This State already has one factory, located in Sandusky County, at Fremont, a short distance from Lake Erie. This factory has been in existence for several years. It has had a struggle in establishing itself, largely through the competitive effects of other well-established crops. This factory has had some assistance in creating sentiment for the sugar industry from the beet-sugar factories in Michigan, and especially does this apply to the northwestern corner of Ohio. In this section of the State a tendency to grow sugar beets commercially is gradually developing. After growing them for Michigan factories the farmers find that sugar beets are a paying crop and afford facilities for better rotation and for stock foods, etc. The farming industry in the State has been so long established and its lines are so well defined that new crops are treated experimentally and conservatively. Development must of necessity be gradual.

Beet growing has slowly spread westward from the factory at Fremont. Of the numerous factories in the State of Michigan, some have been compelled to invade the State of Ohio in order to procure sufficient territory to supply beets for the factory. In this way the northwestern part of the State has been thoroughly covered. This

resulted in a better knowledge of beets on the part of the farmer. Future factories located in this part of the State would not have near the difficulties experienced by the one at Fremont.

During the past year there has been considerable interest in a proposition made to the business men of Toledo for establishing a beet-sugar factory. The proposition is to build a factory of 800 tons daily capacity, provided \$50,000 of the capital is taken locally, the factory to be furnished a site, and contracts to be made with farmers sufficient to grow a supply of beets.

The town of Napoleon is also interesting itself.

The State of Ohio possesses many advantages in the way of fuel, transportation, and local markets, and is in line some day to cut a large figure in beet-sugar production.

UTAH.

The State of Utah already has four large factories and three slicing stations from which the juice is pumped to a main factory. Sugar manufacture from beets in this State has been one of the sources of encouragement to the beet-sugar industry of the whole world. It was one of the first States to successfully manufacture sugar from beets. This was accomplished at its original factory at Lehi. The study of the progress of the beet-sugar industry of this State is largely typical of its history in the whole world.

While it may be said that the sugar factories in the State of Utah are now universally successful, yet the factory at Lehi was conducted under most extraordinary hardships. It had to meet all the obstacles and work out all the problems incident to the establishment of a new sugar factory, and, in addition, to develop proper methods of applying irrigation to sugar beets. Originally it had difficulty in growing beets. The tonnage was poor; the beets were low in both sugar content and purity. These difficulties have all been overcome, as is evidenced by the superior results characteristic of the industry of the State of Utah. So successful has it become that it is the popular field of investment of local capital. There are two sugar companies manufacturing sugar in the State, the Amalgamated and the Utah. Each owns two factories in the State. The extension of the sugar industry proceeds under these two companies. Each one contemplates building one or two additional factories in 1904 or 1905, and each owns a factory in another State, and is either building additional factories or considering plans for additional factories in other States.

It may be said that Utah was the first State to open the eyes of the world as to the adaptability of irrigation to sugar-beet growing. Irrigation is used merely to insure sufficient moisture to produce the crop. Under the natural condition of things an amount of rain falls

in the spring sufficient to start the beets, and enough may possibly fall later in the season to partially or wholly mature the crop. Irrigation is used to supplement nature's supply.

Enough facts were developed in Utah about the relation of irrigation to sugar-beet culture to show the value of this crop in irrigated regions. This inspired factory building in Colorado and other places where sugar beets must depend entirely upon irrigation.

There are a number of additional places in Utah whose conditions have been tested by growing sugar beets for the factories. As soon as the older factories are able to contract the area supplying them with beets one of these new places is likely to build a factory.

Lewiston.—This place is located on the Cub River in Cache County, about the central part of the State east and west, and near the northern line. The farmers have been growing beets for some time for the factories at Ogden and Logan. Lewiston is situated in a good sugar-beet territory. For some time there has been considerable rivalry between two sets of Utah capitalists over the establishment of a factory at this place. It appears that the matter has been amicably settled, and that somewhere in the vicinity of Lewiston a large factory will be erected.

Gunnison.—Beets have been grown quite extensively for some time in the southern part of Sanpete County and the northern part of Sevier County, which have been delivered to the factory at Lehi. There has been talk of establishing a factory at Gunnison, in the southern part of Sanpete County. Farmers have signed contracts for a sufficient supply of beets. The probabilities are that a factory will be located somewhere in this district for 1904 or 1905. It is a district that is well understood through numerous tests, and one abundantly able to support a sugar factory.

WASHINGTON.

For several years this State has been manufacturing sugar at a factory located at Waverly, near Spokane. There are several portions of the State that have been pretty thoroughly tested, and have shown adaptability. The section in the eastern part of the State, known as the "Palouse country," has shown quite remarkable results in sugar-beet growing, and is considerably talked of as a suitable place for the establishment of a beet-sugar factory. The same can be said of the districts around Reardan and Davenport.

Prosser.—Yakima Valley has shown remarkable results in growing sugar beets, and has interested some of the capitalists and sugar manufacturers of Utah, who have made the people of Prosser a proposition to build a factory of 600 tons capacity, provided the people will furnish a site and contract for 4,500 acres of sugar beets. This has all been done,

and the probabilities are that Prosser will have a factory at work in the campaign of 1904. Near Prosser is an additional large tract of land adapted to irrigation and sugar-beet culture; a railroad is required to make this area available for this purpose. Arrangements are pending between the Northern Pacific and the people of Prosser to open up this territory. If this is done it will very much increase the feasibility of establishing a factory at Prosser.

WISCONSIN.

Among those who have been following closely the trend of developments in the manufacture of beet sugar, a feeling has been quite general that Wisconsin would figure prominently. Through the work of Professor Henry at the experiment station at Madison, considerable experimental work has been accomplished in the State. The results have shown that the State as a whole possesses many advantages. It has peculiar climatic and soil conditions conducive to root culture of all kinds. Speaking generally, it was at one time heavily timbered, supporting extensive lumber business. The timber has been removed largely, and, as in the State of Michigan, the other resources of the State are being developed. The upper and northwestern part of the State is an unsettled vast area of stumps. The people of this section during the last few years have been energetically developing plans for reclaiming these lands and bringing them into usefulness.

The climate is too cold for successful corn growing. There is marked success in growing all kinds of small grains, root crops, and grasses, especially timothy and clover. It is developing that certain fruits do remarkably well, especially apples. The home seeker, on account of the stump problem, has been avoiding these cheap lands, seeking those farther west, in the Dakotas and Canada. Having investigated this condition in northern Wisconsin myself, I am inclined to believe that the conditions in that part of the State are ideal for the sugar business. Its advantages may be enumerated as follows: (1) For a new country, such as the upper part presents, it is quite liberally supplied with railroads. These railroads were placed there for the purpose of removing the timber. They are now looking for something to do to enable them to pay operating expenses and dividends on the investment. They are in a position to cooperate heartily with any industry inclined to locate along their right of way. (2) The lands, as a rule, are of good quality, fertile, easily worked, and easily drained. (3) The fertility is due to the centuries of decaying vegetable deposits incident to all heavy forest conditions. There are many creeks, rivers, and lakes. There is an abundance of clear, pure, cold-water springs everywhere. The rainfall is abundant and regular. (4) The lands are remarkably cheap compared with those of any other section possessing equal strength of soil.

The conditions are ideal for organizing and establishing a sugar factory. A factory needs, above all things, a large enough acreage under control of the plant to enable it to grow a sufficient supply of beets during the first few years of its work. Experience of factories already established has demonstrated that such an advantage is almost a necessity. Especially is this true where the factory is located in a new country without its regular supply of farmers adapted to such an emergency as a beet-sugar factory creates.

The lands in this section of the State can be bought for \$3 to \$12 an acre. Sugar affords the most ready means of paying the expense of removing stumps and reclaiming the land. The local lumbering facilities enable temporary arrangements to be made for housing and maintaining laborers and clearing and cultivating the lands. The sugar factory is the one thing that will solve the stump problem in northern Wisconsin and Michigan. That would change the present condition of a large expanse of country, consisting of a wilderness of stumps, utterly useless and nonproductive in its present state, to that of a highly civilized, progressive agricultural and manufacturing community. It would not only bring sugar-beet growing, but it would be the forerunner of general agriculture of every description. It would not only do this, but it would utilize railroads, build up towns, establish banks and mercantile establishments, employ labor, and produce thickly populated communities throughout a district where there is nothing now except an occasional woodchopper's hut or a collection of huts—evidences of once active lumber camps. These pioneers of the forest, in feeding the horses of the lumber camps, scattered the seed of clover and timothy, and it in turn resowed itself until the whole face of the country seems destined to be a vast clover and timothy field, showing that these two valuable tame grasses are adapted to the soil. Some of them planted fruit and cleared small plats of ground and grew oats and small grains, potatoes and other root crops, all of which grew well.

The State is bordered on the north by Lake Superior and on the east by Lake Michigan, both of which are accessible by a network of railroads, and these two kinds of shipping in competition offer for all time the cheapest kind of transportation. Its proximity to the markets of Chicago and other large shipping centers, both by lake and rail, gives it a favorable position in any line of industry. The advantages for establishing the beet-sugar industry are not confined alone to the upper and newer portions of the State. Many of the older, thickly settled, and prosperous communities of Wisconsin are thinking seriously of the sugar industry, and its advantages throughout the Lake Michigan district and the southern and Mississippi River portion have been thoroughly canvassed by leading beet-sugar experts and capital-

ists. Plans are perfected for at least three additional factories for 1904-5.

Some years ago a factory supposed to have about 350 tons capacity was established at Menomonee Falls, Wis. This proved to be one of the mistakes of the beet-sugar industry in the United States. It never made a pound of marketable sugar. The failure was not due to the lack of support of the farmers this time. It was due to the faulty construction of the factory. The farmers grew a sufficient supply of beets, or an amount that would ordinarily be satisfactory to a factory operating its first year. It could not make sugar. The beets were siloed near the factory and rotted on the ground. This location for a sugar factory, from an agricultural standpoint, is ideal, but the results of this factory were very discouraging to the investing capitalists, the farmers, and everybody else concerned. It had a dampening effect on the beet-sugar industry in the State of Wisconsin. The factory finally came into the possession of some Michigan capitalists and others. The factory was dismantled and again equipped with entirely new and modern machinery; contracts were made with the farmers, and the factory was started on its career of usefulness, and has been in operation for the past two years. The results have been so satisfactory that it is serving as an incentive for the establishment of other factories in Wisconsin under the leadership of Mr. R. G. Wagner and those interested with him in the sugar-manufacturing business. For some time they have been carefully investigating four other points in the State with a view to establishing other factories. They have made propositions to those locally interested to build sugar factories at each of these places as soon as contracts for three years are secured with the farmers for producing 4,000 acres of beets annually. Local capitalists are asked to subscribe for 15 per cent of the capital stock.

Wisconsin is in fact producing beets for two sugar factories, as the one at Menominee, Mich., receives beets from the counties of Marinette, Door, Oconto, Kewaunee, and Brown, in Wisconsin. These counties are near the sugar factory at Menominee, surround Green Bay, a part of Lake Michigan, and possess the advantage of water transportation, most of the beets being carried in barges to the factory.

At a number of places the establishment of beet-sugar factories is contemplated. Mr. R. G. Wagner, president of the Wisconsin Beet Sugar Company, has been studying conditions at several places in Wisconsin with a view to establishing other factories. In order to get some insight into the quality of beets grown at these places, and for the purpose of instructing the farmers in the work of growing them, he has been encouraging these different places for the past three years to grow beets for the factory at Menomonee Falls. Last spring he renewed this work. Being entirely satisfied with the conditions and

possibilities of four of the places growing sugar beets, he made a proposition to the business men in and farmers adjacent to the following towns: Chippewa Falls, Watertown, Green Bay, and Janesville. He will construct a factory at each of these places, of 500 tons capacity, as soon as it secures contracts with the farmers to grow 4,000 acres of beets and takes 15 per cent of the capital stock.

Chippewa Falls.—Chippewa Falls has complied with the above proposition and has presented the management of the Menomonee Falls factory with contracts aggregating 4,300 acres of beets. A site has been selected and every arrangement is being made for the construction of a factory at that place. Chippewa Falls is a little east of north from Eau Claire, in Eau Claire County, Wis. It is a thriving little city, possesses one of the largest sawmills in the State, is a large producer of shoes, and possesses many excellent advantages for manufacturing purposes. The difficulties met and overcome by the committee at Chippewa Falls in securing the acreage, and meeting other conditions imposed by the Wisconsin Sugar Company, is illustrative of some of the difficulties met in stimulating this new enterprise. This committee practically made a house to house canvass, public meetings were held in the schoolhouses, and the farmers were addressed by the committee, beet-sugar experts, and others, illustrating the methods of agriculture and the cost and profits of production, and everything pertaining to the farmers' side of the question. Several hundred pounds of beet seed were given out to the farmers, in order to make trial tests. It took most of the summer to do this work. In order to secure $4,347\frac{1}{2}$ acres representing the contract, 2,108 contracts were made, averaging a little above two acres. Assuming, as one of the members of the committee asserted, that each contract called for only two acres what a future possibility it represented in the beet production of that locality, provided the experiment proves satisfactory and every farmer in the future desires to plant more acres.

Green Bay.—Green Bay is another one of the cities selected by these Milwaukee capitalists. During the summer its farming community grew sugar beets commercially. Local interests are endeavoring to secure sufficient contracts to meet the conditions imposed. Green Bay is in the eastern part of Wisconsin, about halfway north and south, and is located at the southern point of Green Bay, an arm of Lake Michigan. Several hundred acres of beets were grown in that locality and disposed of to the factory at Menominee, Mich., during the past season.

A beet-sugar company was organized locally and every effort was made to encourage the farmers to grow beets. Sufficient contracts could not be secured to meet the proposal for the building of a factory in 1904, but the attempt will be renewed next year under the influence of the good results in beet growing and the profits secured by the

farmers the past season. It is supposed that these efforts will be more successful, and a factory will be placed in operation there for 1905. After the beets were delivered to the factory at Menominee, a large delegation of the farmers went to Menominee to see them worked in the sugar factory; also to get some general information about the sugar industry.

Janesville.—This place grew a large acreage for the factory at Menomonee Falls, Wis., under the stimulus of the proposition to build a factory at Janesville provided contracts could be arranged with the farmers for 4,000 acres of beets. This town is nicely situated, is quite a railroad point, and located in one of the developed agricultural sections of the State, being in Rock County, in the southern tier of counties, about half way east and west.

One of the leading agricultural industries of this section is growing tobacco. Sugar beets at this place last season came squarely in competition with the tobacco crop. This is one of the best tobacco districts in Wisconsin. Like sugar beets, tobacco requires considerable care, skill, and labor; there is more risk from frosts in growing tobacco, however, than in growing sugar beets. Beets are also less susceptible to droughts, diseases, insects, etc. However, sugar beets had the advantage, in this place, of falling into the hands of growers accustomed to work, diligent care, and intensive culture. Many of the old tobacco growers decided that sugar beets were a safer, easier, and a more profitable crop, and in the future they will devote their time to sugar beets in preference.

Recently there has developed a lively contest between two contesting firms, each desiring to establish a factory at this place. The Wisconsin Sugar Company, under the management of R. G. Wagner, has been growing a considerable acreage of beets at this place for the past two seasons. The results indicated more than usually favorable conditions for a sugar factory. The vicinity of Janesville is an old established tobacco-growing district. In response to the proposition to establish a factory there as soon as the district could procure contracts with the farmers for growing 4,000 acres of beets resulted in an effort to procure this acreage, which was not entirely successful. Mr. Wagner, the manager of the Menomonee Falls factory then decided to extend the proposition and to build a factory in 1905 if the conditions should be complied with. Recently Captain Davidson and others, of Bay City, who own a large beet-sugar plant of 1,200 tons capacity at Dresden, Canada, made the people of Janesville a proposition to move his plant there from Canada provided the town would furnish him a 20-acre site for the factory. This was done, and it was announced that the factory would be moved there and be in readiness for operation in 1904. The people interested in the Menomonee Falls proposi-

tion then announced that they had decided also to build a plant, and purchased a site of 20 acres 1 mile north of the city, a short distance from the Milwaukee and Northwestern railroads. This plant is to be in readiness for 1904 or 1905. It appears, therefore, at this time that Janesville is to have two large factories.

I submit herewith the report made by J. A. Decker and Walter Helm, of this place, relative to the results of sugar-beet growing in Rock County:

JANESVILLE, WIS., December 29, 1903.

DEAR SIR: Yours received, and I will say that beets raised in Rock County were sold at Menomonee Falls, Wis., to Menomonee Sugar Company. The price received by the farmers was \$4.50 per ton for October delivery, \$4.75 for November delivery, and \$5 for December delivery. Beets were very good here this year, testing from 12 to 16 per cent sugar. I raised 10 acres that go 28 tons per acre. The cost of raising is \$28 per acre. We do not irrigate any. We have a fine prospect for a factory here. The Menomonee Sugar Company intends to commence building a factory here next summer. I visited the factory this winter. The grade of the sugar was very good; in fact, I never saw better.

Yours, very respectfully,

J. A. DECKER.

Walter Helm reports from Rock County, as follows:

1. Between 900 and 1,000 acres were grown in Rock County. There were shipped from Janesville station 6,700 tons grown on 460 acres, averaging 15 tons per acre. I think the whole county will average about the same. The beets were all contracted for and shipped to the Wisconsin Sugar Company, Menomonee Falls, Wis.

2. The contract price was \$4.50 per ton, with 25 cents more for each per cent of sugar per ton for beets testing over 14 per cent.

3. The beets were used in making standard granulated sugar of fine quality, and the beets tested from 11 to 18 per cent sugar.

4. S. H. Joiner, of Janesville, had 1 acre which yielded 44,370 pounds; George Coy, Janesville, 5 acres, 135 tons; Robert Schlater, Avalon, 2 acres, 61 tons; H. Woodstock, Janesville, 4 acres, 84 tons; R. J. Hogan, Janesville, 1 acre, 22 tons and 1,872 pounds. The cost of production will average about \$25 to \$30 per acre.

5. No irrigation is practiced in this section.

6. The Wisconsin Sugar Company are talking of building here, and a letter from them dated January 8 says they hope to have a factory ready to care for the crop of 1905. Some of our best crops I have no report of, as shipping was only finished last Saturday and returns are not all in.

Watertown.—At Watertown beets have been grown since the factory has been in operation at Menomonee Falls. It is about 40 miles directly west of that point, and about the same distance north from Janesville, and is located in Jefferson County, in the southeastern part of the State. The farmers of the vicinity are well informed in sugar-beet growing. Those locally interested have been endeavoring to secure contracts with the farmers, with a prospect of success.

Fond du Lac.—While Captain Davidson, of Dresden, Canada, was negotiating for a site in Wisconsin, with a view to moving his plant to this State, he took the matter up with the people of Fond du Lac. The citizens of that place took a lively interest in the project and pro-

cured pledges of sufficient acreage to operate a plant. When it was decided to locate the Dresden plant at Janesville, the parties locally interested began negotiations with others to establish a plant at Fond du Lac. It appears quite probable at this time that a sugar-beet factory will be located at this place in 1904. It is thought by some that the management of the Dresden plant may reconsider its location, deeming Janesville hardly competent to sustain two large beet-sugar factories at the present time. There is no question about the conditions around Fond du Lac being favorable for sustaining a factory should one be located at that place.

Madison.—Recently the business interests and farmers of the vicinity of Madison, Wis., have been very much aroused over the proposition to establish a beet-sugar factory at that place. A large meeting of those interested was held and addressed by Professor Henry, director of the State experiment station, and others, in which it was developed that the vicinity was well adapted to such an enterprise. A committee was organized to negotiate for capital with a view to the installation of such a factory. From indications at present it seems that this place has a strong prospect of securing the same.

Beaver Dam.—The Milwaukee Sentinel, under date of February 25 says:

The Business Men's Association of Beaver Dam will try to secure a beet-sugar factory. A committee has been appointed to secure the cultivation of 5,000 acres of beets. If they are successful a 600-ton beet-sugar factory will be built. Several mass meetings have been held the last week. Beets have been grown in this section for the last three years with an average of 15 per cent in sugar and an average purity coefficient of 83.

The citizens at several other places in Wisconsin have been giving the beet-sugar industry considerable attention and investigation. The farming conditions surrounding these places have been thoroughly tested by the State experiment station, and in most of them beets have been grown commercially, either for the factory at Menominee, Mich., or the one at Menomonee Falls, Wis. Local capitalists and business men have united in efforts to secure factories for these places, among which may be named Eau Claire, Racine, Kaukauna, and Clinton.

WYOMING.

There are quite a number of valleys in Wyoming available for the introduction of the sugar industry. This State has not attained the same degree of development as Colorado; it is sparsely settled, and new industries do not find as good facilities as in Colorado. Various portions of the State have been examined experimentally with favorable results. Like Colorado, sugar beets must depend largely upon irrigation. There are in the State several good irrigation systems, and others are starting. There has been considerable agitation in the

State at various times and at different places with a view to establishing a beet-sugar factory.

Wheatland.—This place is in Laramie County, in the southeastern corner of the State. A proposition has been made by capitalists to build a beet-sugar factory provided the business men and farmers arrange for contracts for 6,000 acres of beets in the near vicinity. The matter has received considerable attention. A public meeting was held in the opera house, and farmers and citizens participated in a feast, followed by a business discussion of the proposition. A second meeting of this kind was held, and the contracts for 6,000 acres were signed. It seems likely that a sugar factory will be built at this place in the near future.

Wheatland is situated on the Laramie River, which is the main drain of the Laramie Mountains to the west and joins the North Platte near Wheatland. This factory could be supplied with beets from the irrigated lands of the Platte and the Laramie rivers. Two or three plants as large as the one proposed for Wheatland would supply sufficient sugar for the entire demand of Wyoming.

The Sheridan and Big Horn settlements also have been under active investigation, and their adaptability for this industry appears settled. Capitalists have proposed to establish a factory at each of these places as soon as such an enterprise can be assured of a constant and sufficient supply of beets.

CALIFORNIA.

California has been from the beginning the leading beet-sugar State in the Union. It was the first to start the enterprise, and the first to develop it extensively. Most of the factories are large when compared with those of other beet-sugar districts in the world. It has one factory which is the largest in the world. Its annual production of sugar has exceeded that of Michigan although the latter State in 1902 had twice as many factories. It is probable, however, that the final returns for the campaign of 1904 will show that Michigan, with her 22 factories, has produced more sugar than California with her 8 factories, one of which is not in operation.

The factories built in California have been so large that it has taken some time to bring the producing area up to the point of furnishing a sufficient supply of beets. In this way California drew on her future resources. There has been no pronounced tendency to build new factories recently. While there are several places in the State anxious to establish factories, and while these have known conditions abundantly capable of sustaining such factories, yet the general tendency of public sentiment has been in favor of fully providing for the factories now in existence.

In California beets are becoming an established crop. I have spoken

from time to time in my reports of the mutual relation existing between the sugar industry and many others. The sugar industry is helpful to others in several ways. In the first place, it attracts labor, and has a tendency to place it on a more permanent footing, both as to supply and wage; it facilitates rotation, improves the soil, increases the yield of crops and the animals on the farm; it makes a market in the increased consumption of other supplies; it opens and increases transportation facilities, and helps to swell the general volume of market products; it also has a tendency to increase the per capita of money in circulation, and in many ways facilitates all kinds of mercantile business. These things all tend to produce friendly relations between the beet-sugar industry and other industries and a general encouragement of sugar-beet growing. California has reached this stage of development. Sugar production is becoming an established business, much as it is in the older countries of Europe—Germany, France, Russia, and Austria. The former are accustomed to sugar-beet growing, and take it as part of their life work. In California the industry has more nearly reached an established status than in any other State.

In the beginning California growers believed that sufficient rainfall could be secured to mature the crops, and for the first few years this was entirely depended upon. Three years of drought taught them their mistake. Since then irrigation has been brought into requisition more or less. There is a constant annual increase in the amount of beets grown in California by irrigation from artesian wells and flowing streams. This is another thing that has tended to give California a more stable position in sugar-beet growing. It has been discovered also that in many places in the State beets can be planted earlier than was formerly done, and thus secure more moisture from the rainy season. It may be said in general that the State is gradually approaching a permanent and satisfactory supply of beets for the factories already established, and it will soon be in this position with regard to most of the factories. There are many other places in the State well adapted to the beet-sugar industry. These places are known and are held in mind by those interested in increasing the industry in that State, and no doubt in the future additional factories will be established.

In the building of the Isthmian Canal this industry in California will be especially favored, as sugar is one of the products which is not perishable and will stand long shipment by water without deterioration. An isthmian canal would make many of the products of California available in the eastern markets. On account of the lessening of cost of shipment, beet sugar would be one of the chief beneficiaries of such an enterprise. The industries most closely related to the sugar industry in California are the fruit canning, drying, and preserving industries, which are constantly growing, not only in the amount of fruit

preserved, but in the amount of fruit grown. These will be greatly benefited by the Isthmian Canal, and they are large consumers of sugar as a raw material in manufacturing various products.

Sacramento Valley.—There has been a recent revival of the proposition to establish a beet-sugar factory somewhere in the Sacramento Valley. For some time this has been considered a favorable locality for the extension of the beet-sugar industry in this State, and several projects have at different times been under advisement. A recent proposition has been made by Mr. G. S. Dyer, of Alvarado, Cal., who offers to furnish half the money for establishing a plant in this valley, probably at Chico, and the matter has been the subject of active negotiation between him and the Sacramento Valley Development Association.

SUGAR BEETS VERSUS OTHER CROPS.

Considerable has been said in my different reports on the progress of the beet-sugar industry about the advantages of this crop in comparison with other crops. Provided the climatic and soil conditions are all right, sufficient moisture being obtainable either through rainfall or irrigation, and a factory is situated near enough to afford a market for the beet farmer, experience has proven that there is no more profitable crop. There are also many incidental advantages besides that of money profit, among which are the intensive cultivation incident to beet growing, the advantage in rotation, and the usefulness of factory by-products in connection with feeding and dairying.

Aside from these incidental advantages, I think it would not be out of place to show, by comparison with other crops, some of the actual advantages in the way of money returns from actual results in the sugar-beet districts of the country. In this connection I shall introduce some clippings taken from the public press. In traveling over the United States, I have found that each particular section has its favored crop or crops, which from the experience of the past, have seemed best adapted to all the conditions of the locality. It has been an interesting study to watch the development of the sugar-beet crop when brought into competition with those favored crops in the various sections of the country. Time and experience only can settle the public judgment for or against the new crop. Sufficient time has elapsed to demonstrate conclusively, in many instances, that sugar beets will win in these competitive contests. In any district where agricultural and manufacturing conditions are favorable for engaging in the beet-sugar enterprise, indications are abundant that the final judgment will be favorable to the sugar-beet crop.

It is true, however, that no agricultural district should engage exclusively in sugar-beet production. The superior claims of this field crop are set forth here only to demonstrate its usefulness in con-

junction with general cropping, and, as a rule, the more general the better. In no section of the country can agriculture be successful with a single crop. There is no fact more clearly demonstrated than this. It appears that nature never intended that the soil should be continuously drawn upon to supply the needs of a single plant. It follows that where a district has a tendency to a single-crop culture the introduction of an additional crop must be helpful. This is one of the strongest points to be advanced in favor of raising sugar beets. They enter into rotation well and are helpful to most other field crops grown.

MARKET CONDITIONS.

The first great advantage held by the sugar-beet crop above all other crops drawn into this comparison is the fact that it has a fixed market. The farmers know exactly before they start in to produce their crop what they are going to receive for it. They are not bothered by the effect on the market which may be caused by produce gamblers on the boards of trade, or by drought at home or abroad, or by the ravages of insects or diseases. Sometimes the price arranged between the factory and the farmer is what is known as the "flat" price; i. e., so much per ton for the beets delivered to the factory, regardless of the sugar content and purity. Sometimes the price is arranged on a sliding scale, the minimum price being based on a certain percentage of sugar and purity, and an additional amount being paid for each additional 1 per cent or fraction of 1 per cent of sugar. This sliding scale usually results in fluctuation from \$4 to \$5 or more per ton, the result being largely dependent upon the methods employed and the care exercised by the farmers in producing the beets. Taking the country over, the price actually received ranges from \$4 to \$5 per ton, or a little more in case of exceptionally high-grade beets.

CLIMATIC CONDITIONS.

The element of hazard has its consideration in beet growing as well as in other crops. There is probably no business in which money is invested and labor expended that is not more or less affected by the hazards of the enterprise. This is true of farming. Domestic animals have their diseases. Grains, fruits, and vegetables are all more or less subject to the effects of frosts, high winds, beating rains, destructive storms, hail, cold weather, plant diseases, insects, and drought. All these cause more or less anxiety to the farmer.

In deciding what crop to grow the amount of hazard is probably as important a consideration as anything else. With the beet crop the farmer's anxiety is confined to a shorter period. This is the time of germination and the first two or three weeks of the plantlet's life; after that beets may be considered as hardy as any other field crop, if

not more so. Once the thinning is over and the beets have had an opportunity to adjust themselves after this disturbing process, sugar beets are a pretty safe crop, as compared with any other in the face of the above contingencies.

Hail may disrobe it of its leaves, but others will appear, while a crop of grain once beaten down is liable to be a total loss. As to moisture, its greatest danger lies in the growth of weeds and grass, in case the rains are excessive and continuous, but this is true of most other cultivated crops. The beets respond readily when they are once freed from grass and weeds. They shade the ground rapidly and soon completely, and are great helps in their own preservation from these things.

Among the other general advantages possessed by the sugar beet in comparison with other crops is its behavior in the presence of adverse climatic conditions, such as hail, wind, rains, droughts, frosts, etc.

Hail.—In many sections of the country where sugar beets are grown considerable loss results from destruction of growing crops by hailstorms. Such storms occur throughout the Rocky Mountain States and the States growing sugar beets in the rain belt. It is no small misfortune to a farmer who has put in a crop of any kind to have a hailstorm pass over his fields. In many instances such storms utterly destroy crops of corn, wheat, oats, potatoes, and other vegetables. After a certain early period sugar beets seem to be very little affected by such storms. They may be injured more or less and receive a setback for a time, but gradually new leaves appear, and, finally, the beet takes on new growth and appears as if nothing had happened to it. The hazard of the hailstorm is sufficient in many parts of the country to cause the establishment of insurance companies which insure the farmers against loss by hail. The beet crop furnishes its own insurance against this danger.

Last year a hailstorm occurred in Colorado in a sugar-beet district along about the 1st of August. The following clippings from the press of that section indicate the results:

The Boulder (Colo.) Camera: It is said that sugar beets are the only crop in the trail of the hailstorm which devastated Boulder County last week that are not destroyed. Though the beets were set back some, the denuded tops are already growing again.

The Colorado Springs Gazette, August 16: J. R. McKinnie, who has just returned from Loveland, Colo., says that the recent hailstorm which visited the northern part of the State did not damage the growing beet crops in that section. He said: "I inspected the crops with care and found them to be all right. The beets are in good shape and are coming on in good style. The crops will be ripe in about thirty days; so by September 15 the first batch of beets will be ready for cutting, and from then on the harvesting will proceed rapidly. The beets in the next month will take on size and saccharine qualities. Good weather and plenty of sunshine are what make the sugar in the beet, and the indications are very favorable."

The Greeley (Colo.) Republican: It is being demonstrated this year that the sugar-beet crop will stand a good deal of pelting by hailstorms without special injury to

the beets. The hail may cut the tops into ribbons, and even tear the leaves all off, but the beets keep right on growing just the same, sending out new leaves just as if nothing had happened. The loss of the tops may slightly affect the sugar in the beets for the time being, but if they have time to send out new tops before maturity they will recover whatever loss of sugar they sustained.

In European beet-growing countries, we are told, growers go through their fields and pluck off nearly or all the tops for fodder, without in the least injuring the growth or quality of the beets. If this be so, Colorado beet growers need not fear the effects of hailstorms on their fields.

Much similar testimony might be added from this and other sections of the country.

Wind.—It is a well-known fact that in all parts of the country the cereal crops are sometimes damaged by wind. This is not true of sugar beets after they have started a firm growth. The hazards in this respect are reduced to a minimum.

Rains and drought.—It has been demonstrated time and time again, in all parts of the country, that sugar beets can stand more rain and more drought than most of the ordinary crops. The factory at St. Louis Park, Minn., proved this fact conclusively. After a season of drought producing almost a failure in other crops a fairly good crop of sugar beets was secured. During a season of excessive rains, which affected other crops as seriously as the former drought, a fairly good crop of sugar beets was produced. In fact, one of the best crops of beets grown in Minnesota was produced during the very rainy season of 1902.

The taproot and its laterals grow rapidly down into the ground and follow up the retreating moisture strata under dry conditions. Sometimes these taproots will be found as slender threads 12 to 13 feet below the surface. Supported in this way they stand drought better than most plants which keep all their roots near the surface.

There is another adjustable provision of the sugar beet, that while, if dry weather prevails, it may not mature so large, it is liable to store a larger percentage of sugar, in comparison with one grown in more moist ground. If a farmer's contract with the factory is based upon the amount of sugar which the beets contain, he makes up in extra sugar what he loses in weight of beet. His values tend to adjust themselves. An illustration of this occurred at one of the sugar factories which contracts with the farmers to pay on the sliding scale. The season was very dry; the sugar beets were small. The farmers were greatly disappointed until the crop was delivered. It was then found that the extra money secured on account of the higher sugar content of the beets had practically made up for the loss in tonnage. In the presence of a drought, I have called attention many times in my reports to the self-sustaining power of sugar beets in comparison with other crops growing under the same conditions.

Frosts.—The study of the effect of frosts on sugar beets in comparison with other crops reveals advantages also favorable to sugar-

beet culture. There is a time, when sugar beets are very young, just out of the ground, when they are very susceptible to frosts, but they soon pass this stage and become very hardy in this particular. During the past year other crops were almost entirely destroyed by frost in some sections where sugar beets are grown, while the latter made a fairly successful crop. This fact was illustrated at Menominee, Mich., during the past summer. On account of the long period in the spring during which beets can be planted, it is easy to replant. but with many other plants this is not so readily done.

It is in the fall, however, when the real power of the sugar beet to resist the frost shows itself. There is hardly a fall passes when the farmers and those interested are not more or less anxious as to the appearance of early frosts. This is always true of the corn growers in the corn belt, and in a farther northern section of the country it is true of the growers of wheat and other small grain. It is true also of farmers who raise sorghum, tomatoes, and most of the garden vegetables. It requires considerable freezing to affect sugar beets; and even a freeze will not injure them provided the ground thaws out sufficiently to harvest them; or in case they are out of the ground when frozen, they can be delivered to the factory and worked before they thaw again. Of what market value are potatoes and other vegetables after freezing? The anxiety on the part of the farmers about the sugar beets freezing is very small in comparison with their anxiety about almost any other crop that can be mentioned.

FINANCIAL CONSIDERATIONS.

During the past year beets have been grown experimentally under the superintendence of the different sugar-manufacturing companies at a great many places in new fields. After the work of the season was over and the beets were delivered to the factory, in many cases the farmers from these experimental districts have gotten up excursions and visited the factories in order to study their operations, beneficial effects, etc. These visiting farmers, in making up their reports to those whom they represent, have generally stated that one of the main advantages of beet production is the increased circulation of money in sugar-beet districts, and that the crop is remarkable in facilitating the payment of mortgages, interest, taxes, etc.

COMPARISONS WITH OTHER CROPS.

Tobacco.—In several parts of the country sugar beets have been brought into comparison or competition with tobacco as a farm product. In parts of Wisconsin and New York tobacco is one of the main crops, and it has been considered a paying crop. It is one of the best crops to compare with sugar beets from the fact that its culture is intensive,

laborous, tedious, and expensive, the same as that of sugar beets. While profitable as a rule, it is much more uncertain as to both the growing of the crop and the amount of profit.

In order to bring before the public the view of those who have actual experience, and are, therefore, well posted, I will offer a few clippings from the press touching this matter. A farming section around Janesville, Wis., has been for some time devoted to the culture of tobacco. The following is from the *Janesville Gazette*, in October, 1903, under the heading, "Forsakes tobacco for sugar beets—John Timmons, who has given up culture, predicts widespread change."

"This is my last year with tobacco; I have been raising it for twenty years and am going to quit," said John Timmons, who resides on the Beloit road about 3 miles from Janesville, in speaking about the general crop conditions. Mr. Timmons says that sugar beets will occupy his attention in the future. "The tobacco land is suited to them, and with an average yield of 15 tons an acre, which will sell for \$4.50 in the market, the returns will be about as large as from a good yield of tobacco. The beets are underground and we don't have to run any risk from high winds or frosts. Then the tobacco market is a good deal of a gamble, and one can never tell what he is going to get for his crop. During the hard times of 1893 and 1894 I did not sell my crop; I put it through the sweating, and, finally, after much effort, disposed of it at 5 cents in 1895. About the same time the traveling men were smoking pipes and few cigars were being sold. In 1896 the market brightened up and if I had retained my holdings, which I sold at a loss in 1895, until then I could have gotten 10 cents a pound. Sugar beets," continued Mr. Timmons, "can be raised at much less cost than tobacco. The large amount of labor required and its present high price make the cost to the grower a large one. In my opinion many acres heretofore devoted to tobacco will be turned over to sugar beets in the next few years. If you can't sell your beets you can use them for fodder, but if you can't sell your tobacco you can use it for nothing, and this sort of reasoning is bound to appeal to the farmer who has a crop or two ruined by the storms." Mr. Timmons says that the tobacco crop this year has been a good one and the price for what he has sold has ranged from 8 to 11 cents.

The *Syracuse Standard*, New York, has the following to say with reference to tobacco growing in that State, under the headline, "Farmers are blue—Acreage devoted to tobacco is very much reduced."

BALDWINVILLE, May 16.

Farmers in this section are becoming discouraged over the continued dry weather. The scarcity of rain is almost unprecedented at this time of year, and the hay crop must of necessity suffer. The soil is so hard and dry that plowing is more difficult than it has been for years. The acreage which will be devoted to tobacco this season continues to be an interesting topic. It can not be denied that it will be smaller than it was last year. Many of the largest growers will not plant so much and the smaller growers will go out of the business entirely. Considerable land which has hitherto been given over to growing tobacco will this year be devoted to sugar beets and tomatoes.

The following is a clipping from the *Madison (Wis.) Democrat* of October 21, and presents a view of a reporter who made a trip through the various agricultural districts of Wisconsin. I have simply clipped what he had to say about sugar beets and tobacco under the following headlines: "The sugar beet versus tobacco—Not so hard on land, and

requires less care—Also more profitable—A safe crop whose cultivation ends by mid-July and that may be harvested late—Growing interest manifested in beets all over the tobacco region.”

But it remained for us to see the finest tracts of tobacco growing along the right of way from Portage to Madison, on the Chicago, Milwaukee and St. Paul Railway. The patches, and in some instances quite large fields, were in fine condition. * * * The plants were about 2 feet high when we saw them. They looked very thrifty, and unless a hailstorm comes or this cold weather continues there will be a fair crop. But it was in Rock County that we were completely taken back by the change made in the vicinity of Janesville, where several fields of beets were grown by the farmers who had formerly been heavily interested in tobacco culture. These farmers told me that it was a snap working in beets compared with tobacco. “Why,” they said, “you plant the tobacco seed in March in hotbeds. You have to watch and care for it like raising early spring lambs. It must be watered, nurtured, and kept clean until June. Then you have the laborious task of transplanting, taking several men to plant and take off an acre in one day. Then if it is dry weather the plants will die, and the field must be replanted. The plants are put in rows, and average 18 inches apart in the row. No sooner are they in a fair way to grow than insects and worms attack them. They must be cultivated incessantly and hoed about the plants; and, when the stalk blossoms, each bud must be picked off, this being extra and constant labor. Then come the harvest and the curing.” “Why,” says one farmer, “I would rather take care of 10 acres of sugar beets than 5 of tobacco; and from the outlook here we feel that the beet crop will far exceed the tobacco, and with less expenditure of labor.” In regard to the sugar beet, every field in Rock County that is raised by an old tobacco grower is clean of weeds. The Rock County farmers know how to get the best result in beets, as well as in tobacco, and they will have it this fall when they ship their sugar beets to the plant of the Wisconsin Sugar Company.

Potatoes.—One of the strongest competitors that the sugar beets have had to meet in the field is the potato crop. It is almost established in this country that where you can grow potatoes successfully you can grow sugar beets. It is at least a fact that the sugar-beet industry is entirely successful in competition with potatoes in their strongholds, such as Greeley, Colo., upper Michigan, and parts of Wisconsin. Longmont, Colo., is also a heavy potato-producing section. The following clipping from the Pueblo Chieftain of October 30 indicates the interest aroused in sugar beets in one year:

Potato and beet crops will bring over \$1,000,000. One thousand freight cars have been ordered in which to haul away the potato crop, and there are 100,000 tons of beets in the field which will bring \$4.50 per ton to the farmers. Aside from these are oats, wheat, and rye crops, which will add another \$1,000,000 to the total. Longmont can say that “she is strictly in it” financially this year.

Traverse City, Mich., is a farming community which is almost entirely devoted to potato culture. It is the main crop. Below is given a clipping from the Traverse City (Mich.) Eagle of November 19, 1903, containing an expert's view of sugar-beet growing in this potato stronghold:

S. C. Dickinson, who has been in this city for several weeks superintending the shipping of the beet crop, of which only one car load remains to be forwarded to the

factory, stated that he did not think it would take a great deal of hustling on the part of Traverse City business men and only a comparatively small amount of local capital to land a factory this year. "Farmers who have grown beets this year told me that they would grow beets again next year," said Mr. Dickinson this morning. "Other farmers have made inquiry. A much larger acreage could be gotten next year with much less effort than was needed this year. Even at 50 cents a bushel, I don't think potatoes have much the best of sugar beets as a money maker for the farmer. Although the soil is a little light here in most places for beets, we have had yields of 17 to 19 tons to the acre this year. At \$4.60 a ton, f. o. b., that would mean from \$78.20 to \$87.40 an acre. It would take over 150 bushels of potatoes to the acre to yield that much money. Sugar beets are not so much more expensive to raise than potatoes. They are expensive to thin, but it takes money to Paris green potatoes. Potatoes are a more uncertain crop than sugar beets. They are subject to blight, and a little frost hurts them. Here we are shipping sugar beets in coal cars. I don't think it would require much hustling on the part of the Traverse City business men to land a factory next year. Our people are anxious to build one here. Traverse City doesn't realize what one would do for the town." Mr. Dickinson submitted a sample of beets grown on George Heinforth's land, near Bingham, for analysis by the chemist of the Valley Sugar Company. The return he got was 16.3 per cent. The company this year paid in their sections of the State \$4.50 for beets running 12 per cent sugar, and 33½ cents for every point above 12 per cent. At this rate the Heinforth beets would have brought \$5.94 a ton delivered at the factory. If a factory were established at Traverse City, it would be seen that Mr. Heinforth's beets would bring nearly \$6 a ton. The test was made some little time before the beets were harvested, and Mr. Dickinson says he believes that later samples would show a higher percentage of sugar, and consequently command a higher price.

Menominee, Mich., produces among other things potatoes along with small grains. Below is a clipping from the Menominee (Mich.) Herald of October 1, showing the hardiness of sugar beets where other crops had been ruined by frost, under the following headlines: "Sugar beets save farmers from financial losses—Potato crop ruined by frost and excessive rains in county—Oats growth stunted by early frosts, and crop is worthless, leaving sugar beets the only paying crop this year—Their growth has been most remarkable."

The excessive rains of the past few weeks and the heavy frosts for the past week have damaged the crops in Menominee County to the extent of thousands of dollars, and the farmers are much discouraged over the outlook for the winter. Reports from the rural districts are to the effect that the excessive moisture in the ground with the early and heavy frost has rotted the potatoes. The frost has prevented the filling of the kernels in the oats, and this crop is a failure, while there is little or no wheat. The only crop which is looking well and which will net the farmers much will be the sugar beets. The beets are looking fine, and those who own the largest acreage have reason to feel gratified. The beets are not damaged by the rain or frost, and are ready to be harvested in three or four weeks. Ira Carley was in the city Saturday, and he has made the statement that the crops this fall were a dismal failure. The potato crop was practically ruined, oats are worthless, as the kernels are not full and healthy, and there is little corn. Sugar beets are the redeeming crop this year. Unfortunately many farmers have planted too small an acreage in beets, and will only be proportionately rewarded.

Mint, cabbage, and garden truck.—At Lyons, N. Y., the farmers had

been accustomed to growing peppermint, cabbage, and other vegetables. It was thought at the time of the establishment of the factory at this place that this would be advantageous to the sugar-beet farmers, from the fact that the farmers were by experience accustomed to more intensive methods of farming. The factory management discovered that the farmers were so wedded to these other crops that they were reluctant to give them up for a newer one. The development of sugar-beet growing around this factory has been one of long drawn out effort. The same is true of the one at Binghamton, N. Y. The discouragement of these two factories in their early efforts to overcome the obstacles presented by other specialized crops has had the effect of dampening the ardor for other factory building in the State. Sugar beets have been slowly but gradually winning at both places. Both of these factories this year received a good supply of beets, and have every encouragement of greatly increasing this supply for next year.

Cereals.—Below I offer some general data in which sugar beets are brought into comparison with cereal crops in various parts of the country.

The following is from the Elmira (N. Y.) Evening Star of November 24, referring to sugar-beet growing at Leroy, N. Y., under the following caption: "Sugar beets pay better than wheat."

Farmers about this town are very well pleased with their trial of sugar beets. It is only within the last year or two that the experiment has been tried here to any extent. While the acreage has not been as large as that of many other crops, it has demonstrated the fact that the land around Leroy is well adapted to this crop, and next year the acreage will be much larger. Those who have raised beets this year will receive good returns for the crop, and it is said that it pays much better than wheat, which has always been one of the principal crops of this section. Now that the price of wheat is so much lower than it used to be, the farmers are every year putting in less and less of this crop.

The following is from the Fort Collins (Colo.) Courier of August 7, 1903, referring to the general crop prospects of that vicinity, in which the yield of sugar beets is brought into comparison with several other crops, as follows:

Careful estimates, based on present appearances and conditions, made by well-informed, conservative men, place the yield of leading products at the following figures: Sugar beets, from 15 to 30 tons to the acre; wheat, from 40 to 60 bushels to the acre; oats, from 60 to 75 bushels to the acre; barley, from 45 to 60 bushels to the acre; potatoes, from 125 to 175 sacks per acre; alfalfa, from 4 to 6 tons per acre.

The following is from a newspaper published at Bloomington, N. J., November 28, in which are given some statistics of production and cost of production of several crops in comparison with sugar beets in the Red River Valley of Utah:

Mr. H. L. Schmutz, of Tremont, was in the city yesterday en route home from Bear River Valley, Utah, where quite a number of Tremont people are now living. This

is his fourth trip there, and he is much pleased with that country, but has no idea of removing there. He reports the Tremont colony as being prosperous and contented. Mr. Weise, of Tremont, who went there five years ago, raised 60 acres of oats this year that averages 135 bushels to the acre, 16 acres of which averaged 138 bushels per acre, oats being 33 cents a bushel in that country. Mr. Weise had 25 acres of potatoes that went over 200 bushels to the acre, and 4 acres averaged just 500 bushels per acre. Several of the Tremont colony grew sugar beets last season, and these averaged 28 tons to the acre, bringing \$4.50 per ton. Mr. Weise received \$86 an acre for all the beets he raised. Mr. Gideon Winsler, another old Tremont man, had 200 acres of oats that went 65 bushels per acre. Mr. Samuel Imthurn, formerly of Tremont, had 4 acres of beets grown in an apple orchard that went 15 tons to the acre. Mr. Schmutz says he saw lots of potatoes that would weigh 5 pounds apiece. From 20 to 45 bushels of wheat are grown to the acre, and it sells for 80 cents a bushel.

DATA REGARDING COST OF PRODUCTION.

Anything on the cost of production of sugar beets that is authentic and based on actual experience is always interesting to the prospective sugar-beet grower. Below I give a clipping from the St. Louis (Mich.) Leader of April 30, 1903, giving an interesting experiment conducted at the factory at Holland, Mich., which gives the averages of the cost of production of beets obtained by eighteen of its leading growers:

In the twentieth annual report of the State Bureau of Labor concerning the beet-growing industry is given a table showing the cost of raising and delivering beets to the Holland sugar factory by eighteen growers in that vicinity. The report shows that the average cost of raising an acre of beets was \$23.82, and the average cost of delivering was 61 cents per ton. The cost of seed per acre ranged from \$1.35 to \$2.70, the average being \$2.18. The cost of plowing per acre ranged from 75 cents to \$2.00, the average cost being \$1.25. The cost of harrowing per acre ranged from 75 cents to \$2.00, the average being \$1.15. The cost of sowing per acre ranged from 30 cents to \$1, averaging 61 cents. The cost of thinning ranged from \$2.50 to \$7 per acre, the average being \$4.03. The cost of weeding four times ranged from \$2 to \$5 per acre, the average being \$3.86. The cost of cultivating ranged from \$1.25 to \$6, the average being \$3.90 per acre. The cost of harvesting was from \$5 to \$8, averaging \$6.50 per acre.

LIVE STOCK AND SOIL FERTILITY.

In former reports I have often called attention to the value of sugar beets as a farm crop because of the opportunity to use the by-products of the sugar factory in stock raising and stock feeding. Sugar beets and beet pulp give the farmer an ideal opportunity to restore the fertility removed from the land by the crop by feeding the pulp to his stock and enriching the soil again with the resulting manure. It is interesting at this point to read an article from the Agriculturist, by Prof. W. A. Henry, director of the State experimental station of Wisconsin. Speaking of his observations recently in Germany, regarding the disposition of the people to grow beets for the factories, he calls attention to the mutual relation of stock growing and beet grow-

ing and the perpetuation of fertility of the soil under the following caption: "Sugar beets and soil fertility."

Growing sugar beets is in the end no more injurious to the soil than the growing of most of our common crops. Any crop grown takes fertility from the soil, but if the beet leaves and the tops cut off are fed on the farm, also the culls, and if, finally, the pulp residue is brought back from the factory and fed on the farm, then very little fertility, indeed, is lost. Beet growing is not one-fifth as hard on the land, under such conditions, as the growing and selling of hay or straw, so often practiced by farmers. The beet root takes a good deal of water from the soil, and this, perhaps, shows on the next crop unfavorably. Beets should always be grown in rotation. In Europe the farmers of Germany, France, Belgium, and in other countries have in some regions been growing beets successfully and profitably for the last generation. During the last ten years the business has increased enormously. The beet-growing regions of the Old World have been the most prosperous of any in Europe, and the farmers have steadily improved their farms. They keep more stock where beets are grown in Europe than they kept before they grew beets. I have visited the beet-growing regions of several of the Old World countries, and I know that as beet farming has increased the country has grown prosperous and rich, and the keeping of live stock has increased.

THE INFLUENCE OF THE BEET-SUGAR INDUSTRY.

GENERAL INFLUENCE OF THE INDUSTRY.

Nothing can be more apparent than the evolution of system and the improvement of methods taking place in the beet-sugar sections of the country. The influence of this industry is affecting the industrial and social status of every community possessing a sugar factory. In the neighborhoods surrounding our older factories, this change is observed by travelers and tourists from other parts.

It is no uncommon thing now to read in periodicals interesting stories of the observations of visitors to Colorado and California during the beet-growing season. The influence of the beet-sugar industry on agriculture in general, its social aspects and general business effects are the themes of these writers.

The growing of sugar beets is started first as an experiment on the part of the farmer; next it becomes a sort of rotation crop, and finally it becomes a leading staple crop, and its influence becomes dominant in the agriculture of the community. To those who have been abroad, or who have carefully read the accounts of observations of others in older countries where conditions are more permanent, it has always been interesting to note how the life and events of the agricultural communities depend on some particular industry. Children grow up in an atmosphere where this industry is the theme of their breakfast talk, and is in some way related to their programme of social recreation. For men it is the "shop talk" of all conversation; it is the prelude of Sunday service; the matrix of political interest; the text for agricultural propaganda. For women it is the vital function dominating the

prosperity of the household, and the possibilities of the pantry and the wardrobe. It is celebrated in song, becomes the theme of the writer, and is the inspiration of art. Any well-regulated picture gallery, library, or musical institute will reveal how readily these old-established industries are perpetuated in stories, works of art, music, and literature. How familiarly portrayed are the wine growers of France; the reapers of the grain-growing districts; the orange growers of Spain and Italy; the potato grower of Ireland.

The fame of the Angelus is based entirely upon the faithful reproduction by the artist of the simplicity of rural people engaged in a single industry. Much more might be said along this line, but enough has been said to indicate the social influence of sugar-beet growing in our agricultural districts of America. A sugar factory is built up in a hitherto quiet agricultural community and becomes an intensifier of all interests. Gradually the whole farming community is drawn into the work of producing its supply of beets. Every programme of the farm is eventually based upon accomplishing this object. The years roll on, and the children born into this agricultural community become adepts in the work. They have absorbed every detail of the relation of this industry to themselves. It is their bread and butter, their employment, their constant subject of business discussion; its fortunes are theirs. It is the inspiration of their lives. Every advantage it presents is known and appreciated by them.

In order to get some glimpse of the future in many districts of the United States it is only necessary to take a journey through France, Germany, or Russia, where immense areas of land are devoted chiefly to the cultivation of sugar beets.

SOIL IMPROVEMENT.

There is another thing that has been thoroughly established in these old cultivated districts of Europe, and that is in the action of the lands themselves, after considerable use in producing beets. There seems to be a sort of adaptability in lands that comes from continued systematic growing of beets in rotation with other crops. The beets grown on these lands have greatly increased in tonnage, sugar content, and purity. The same thing is also taking place to a remarkable extent in this country in the older districts.

Of course a portion of this increased productiveness can be accounted for as the result of better manipulation of the soil by the farmer. He has clearer and more settled ideas of the best way to do things, but I do not think this will account for all of it by any means. The close cultivation, the balancing of the elements of soil fertility, by systematic fertilization and rotation have much to do with it. Beet growing necessitates putting the soil into fertile condition and the elimination

of extraneous elements. By repetition, these efforts produce a condition of "educated soil" so to speak, which not only produces better sugar beets, but greatly improves the quality and yield of other crops.

Anyone who has read up on the preparation of the soil and methods of harvesting the beets, or who has given a close study to the subject by personal observation, must be impressed with the permanent improvement rendered the soil by these operations. In addition to subsoiling, the complete stirring given the upper 9 or 10 inches of the soil in the rotation cycle, which includes beet growing, the constant pulverization and cultivation which it receives must be very beneficial. If we add to this intensive cultivation systematic intelligent fertilization, the general and permanent benefits to the soil will be still greater and more apparent. Its mechanical condition is such as to produce the best results, and its supplies of plant food are more available. It must be evident that such a piece of ground is better adapted to all kinds of cropping, and experience demonstrates that it is.

It is a general observation that a garden carefully worked and managed is the most productive part of a man's lands. This is on account of the extra care in handling it and, as a rule, the fertility artificially put into it. It goes without saying that if all parts of a man's farm could be handled for a series of years the same as his garden, it would be much more productive as a whole. This is what sugar-beet growing accomplishes. It brings the farm under the influence of garden culture, and in addition to this it brings the farmers of the whole community under the influence of better methods of culture. The tendency is for all the farmers to use better methods and secure better results with all crops.

Recently I inspected a sugar beet that had been slushed out of the ground, with its top and roots, including its laterals and rootlets, as nearly intact as possible. The beet itself was ordinary in size (weighing about 3 pounds). The number, length, and mass of the roots is something startling to one not familiar with such things. The mounted laterals are ranged in festoons extending several feet each way from the beet. The tap root is about 11 feet long, and it is claimed that this is not all of it. With its thousands of tiny rootlets, it presents a mass that seems incredible. The only thing I can think of in comparison, as it hung in its case, was a small fish seine hung up to dry. Now then, the taproots and the other large roots penetrate the soil and the subsoil several feet. When the beet is harvested they decay. They must leave their cylindrical apertures more or less intact. This influences the soil more or less for 12 feet or more in depth. Continuous crops of beets repeat these operations. The effect through capillarity on the physical properties of the soil must be very great

especially on drainage and circulation. In this and many other ways, known and unknown, beet lands acquire very high productiveness.

INDUSTRIAL EVOLUTION.

The thing most needed on the part of the beet-sugar industry now is the sympathetic influence of the press, the public, and statesmen.

The sugar factory is a blow at idleness and a resource of industry. It puts ten men to cultivating the soil where one worked before, thus increasing the sustaining power of the soil ten times. - We hear a great deal of concern expressed as to what is to become of future generations, now that the public lands have been most generally appropriated. Why should we concern ourselves about an increase in area which can not be had, when we can make the areas we already have ten times more available in furnishing employment and sustaining life?

We are just closing an epoch of original settlement of a territory that seemed endless in extent and boundless in resources. The era of manufacturing is already well begun. Manufacturing industries offer means of employment and sustenance for the surplus population which formerly went to settle the great West. This is the epoch of industrial centralization in which raw materials are worked into the finished products. Our achievements during the last century were wonderful, but those of the century just commencing will be vastly greater.

Anyone studying the conditions in densely populated States like New York, Pennsylvania, and Ohio and observing the relations existing between the farm, the factory, and the mine can not fail to be impressed with the results which will follow a similar development in the rest of our area.

On account of the character and source of its raw material the beet-sugar industry must be distributed throughout the country. This makes necessary the coordinate development of agriculture and manufacturing, which brings with it many advantages and opportunities. The beet-sugar factory, therefore, appeals in many ways for recognition. There is no other industry at present that seems so capable of producing this development of manufacturing in the agricultural districts of the North and West.

The States whose industries are dependent upon irrigation have just begun their development. The sugar industry is one of the most important factors in this development. It is rapidly increasing the population and wealth wherever introduced, building up towns and furnishing employment to thousands where but a few years ago such employment did not exist. Irrigation and the sugar mill are rapidly developing agriculture in States of the arid West whose chief interests were in mining.

A prominent writer once said:

A man who engages in mining is constantly drawing upon his principal. One who engages in agriculture simply draws his interest and increases his principal.

Another writer of prominence, studying the recent industrial development of the West, has said:

The States engaging in agriculture through irrigation have resources sufficient, when fully developed, to sustain in affluence 80,000,000 people.

While we are proud of the achievements of this country to-day, of its rapid growth and development, I confidently believe that the above sentiment will be realized within a century. There are a great many things in the sugar-beet industry that must be worked out in order to put it in the position which it occupies in the countries of the Old World, where it is the life and the hope, the meat and the drink, the inspiration and the realization of human effort. That these are slowly but gradually being worked out is evident where the industry has been established long enough to demonstrate its tendencies.

A HOME MARKET.

It is well understood by all farmers that a home market for their produce is very much better than one far distant. The cost of transportation is saved and they are largely the beneficiaries. Every community is aware of the local benefits incident to the establishment of a manufacturing industry or anything which has a tendency to increase the population to any considerable extent. Merchants and business men of every city give considerable attention to this subject. Every advantage accruing to the merchant or business man accrues also to the farmer. In the case of a sugar factory the farmer enjoys the larger share of the advantages. Attention has already been called to the fact that it requires ten men to a given acreage in sugar beets where it requires only one with ordinary field crops. This increases the population on the farms themselves to a remarkable extent, and each sugar factory requires from 200 to 400 laborers. These must all be supplied with produce from the gardens, fields, dairies, poultry yards, and orchards. A similar demand affects the business of the merchant, the banker, and local business men in all other lines.

It has been estimated that several towns have been actually increased in two or three years to the extent of one-third their population entirely on account of the additional business and opportunities caused by the location of a sugar factory. We have on record two towns—viz, Oxnard, Cal., and Sugar City, Colo.—that sprung up in two or three years to a population of several thousand, the former where nothing existed before but fruit farms, the latter where there was nothing but wild, arid grazing lands.

Evidences are abundant that wherever a sugar factory is located it has a tendency to increase the population of its local town in addition to the increase in field and factory labor. This further improves the home market for the farmers and business men of the cities,

BUSINESS COOPERATION.

In my last report, I pointed out some interesting experiments in growing sugar beets purely from a business standpoint. I desire again to call attention to the business opportunity presented by the sugar-beet crop. There is hardly a factory in the United States whose supply of beets is produced entirely in its vicinity. Towns 50 to 75 miles away, located on a line of railway running to the factory, can encourage sugar-beet production in their vicinity and reap a profit.

Many of these places do not have the facilities for establishing a factory, although they possess first-class facilities for growing sugar beets. Business men in such places are not as a rule entirely absorbed in their particular line of business. They are looking for other investments in which they can make a reasonable profit.

I called attention last year to certain cooperative organizations at Fremont, Nebr., and other places. In Fremont the business men banded together for the purpose of growing sugar beets, organized a company, capitalized it, hired a competent beet grower for a manager, rented a tract of land, purchased implements, grew beets for a factory at some distance, and realized a dividend of 25 per cent, over and above the cost, with implements sufficient on hand and in repair to repeat the operation the following year.

Such organizations are made for different purposes. At Fremont the organization was formed with a view to encouraging the establishment of a factory at that place, the main object being to demonstrate that sugar beets could be grown at a profit by the farmer. In demonstrating this, they also demonstrated that it was a practical proposition from a business standpoint for business men to organize and capitalize simply to grow sugar beets. In what other investment is a man liable to realize so large a profit as that mentioned above?

Here is an example set by the business men of Valparaiso, Nebr., during the past two years. It was conceived here that something should be done to employ the time of the idle labor, of which there was considerable around the town, during the cropping season. The beet-sugar industry was looked into, and an organization was effected. Lands were rented near the town and sugar beets were grown. Everybody was offered employment that wished it. Merchants largely took stock in the enterprise purely to create the opportunity for the employment of labor.

In this case, because the business was new and untried, and for sev-

eral other reasons, the enterprise was not highly profitable, but it was highly satisfactory to the merchants conducting it—in employing the labor of the town, increasing their sales of goods, and promoting collections of bank accounts on their books. From this standpoint it was considered a great success, and the business will be continued and enlarged. Incidentally it was a boon to the town, and if only expenses were paid, the project was successful. Prosperity and idleness can not both exist in the same place. The same idea could be put in practice in hundreds of places throughout the country.

Many of these small towns are built up merely on the trading resources of a small area and are limited entirely by such resources. In many instances the building of other towns is constantly encroaching upon these. Successful beet raising requires special implements; it requires special instruction in the beginning, and should have special oversight throughout its continuance, year after year. A farmer engaged in general cropping, in order to grow a small acreage of beets, is not prepared to invest in the implements. Neither can he afford to secure the special oversight of a competent person for so small an area. Possibly he can not get the special labor required. The merchants' organization of the local trading point should put up sufficient capital to buy the implements—seeders, cultivators, and harvesters—rent them to the farmers, provide a competent agriculturist to oversee the work, and bring labor to do the work, and for repayment of the sums thus invested the crop should be pledged and the money should be returned at harvest.

Suppose such an organization should raise sufficient money, in addition to this, to rent a thousand acres of land in the near vicinity of the town, hire the idle labor, grow beets, and sell them to the factory. This would require a capitalization of say \$10,000. This would meet about one-third the expenses, but would be sufficient to carry the crop to the market. If the land was half the amount, a capitalization of \$5,000 would be required. This money is to be invested in a project that brings back the principal with good profits, opens up a large demand for labor, and pours into the private accounts of the investors and laborers of that locality considerable money each season, all of which enters into the local business—enhances the profits of the merchants, pays the debts of the community, and produces prosperous times generally. Let us examine what the possibilities of such a project are.

The rent of the land (1,000 acres at \$5 an acre) \$5,000. The rent of such lands for ordinary purposes would be \$2.50 to \$3. The increase in rent value to the farmer is therefore \$2 or more per acre. Ten tons of beets per acre in a beet-growing section, rightly superintended, is a small average. At this rate the yield would be 10,000 tons of beets, whose value at \$5 per ton would be \$50,000,

Can anyone fail to appreciate the influence of the receipt of \$50,000 annually in a small community surrounding a town of, say, 1,000 inhabitants? It would swell the volume of business of all kinds; it would enhance the value of real estate and increase the rental values throughout the district.

Now, to proceed with the calculation: It would cost \$30,000 to grow these beets, largely paid out for labor and expenditures in the local community. This leaves a clear profit of \$20,000, which would pay back the original capital of \$10,000 and leave \$10,000 in the hands of the organization for carrying on the project another year, with the implements on hand and everything in readiness.

I submit that the estimate is based on the fairest probabilities, both as to cost of production and as to tonnage per acre. It shows conclusively that the only thing required of a small town in an agricultural district accessible to a sugar factory is sufficient energy to start the ball rolling in order to completely revolutionize business.

GROWING SUGAR BEETS.

SUPPLY OF BEETS.

In its inception every sugar factory has to start under a great many unfavorable circumstances and has to overcome many obstacles. Most of these are due to the present lack of the centralization of influence, such as we find in the beet-sugar districts of European countries. For instance, if for any reason the season has been unfavorable in Germany or France, there is no tendency on the part of the growers to become discouraged, abandon the crop, or try something else the following year. They have witnessed the results of beet growing year in and year out. They know its benefits as compared with those of any other crop available under the conditions. In the sugar-beet districts of this country, if a farmer should try beet growing one year and for some reason score a whole failure or partial failure, he is very liable to decide that sugar beets are a poor crop and to change to something else.

This means lack of stability in the supply for the factory and a constant solicitation on the part of the management to secure even a moderate supply of beets. I have been reliably informed that the difficulties of the sugar manufacturers in these older countries are not of this kind. They are concerned only with securing as large a pro-rata share as possible of the sugar to be manufactured in the allotment to the different factories, a matter which is governed by their national organization. The factories, in turn, dole out to their growers the amount of beets each may produce. This is the result of a settled order of things.

The farmer as a rule is conservative. He is slow to take up a new crop, and slow to abandon it once he has become familiar with it. There is much to be gained when this conservatism shall operate in

favor of sugar beets instead of against them. This will, in fact, eliminate the greatest obstacle the beet-sugar factory has to meet at present. Every factory now established had to begin this battle for supremacy of the sugar beet in its farming district. To secure a supply of beets is the thing of greatest importance.

There are now 56 factories in the United States, each of which is working more or less strenuously in this contest. With many of them it is a drawn conflict. Many of them have gotten beyond the danger line and are on the high road to permanent success in the beet-sugar industry. Some of them are struggling along with the balance more against them than in their favor. A few have succumbed—have been dismantled, or retired from the field.

Is it not apparent that these factories will have achieved a great victory, that they will be working under a much more favorable order of things when sugar-beet raising becomes a fixed and not an experimental industry? Imagine the difference between the pioneer work described above and that in a community in which the sugar-beet crop has long been the dominant factor in the social and industrial life!

Some of the factors on which depends the development of the beet-sugar industry in this country are presented in the following paragraphs.

SELECTION OF THE SOIL.

The first requisite in successful sugar-beet growing is a suitable soil. This will become more evident to the farmer as he proceeds with the crop. There is no doubt that the beet crop makes a heavy draft upon the soil, and should be classed in this respect with corn, potatoes, and tobacco. It quite often happens that the farmer selects a piece of ground for growing sugar beets not well adapted to growing other crops, and not considered productive. If a soil is light and sandy it should be avoided for the beet crop, unless, through rotation of crops and fertilization, it has been brought up to the right condition for sustaining such crops as corn and potatoes.

I am often asked the question, "Do sugar beets exhaust the soil?" The proper answer to this question is that any crop will exhaust the soil if planted continuously and nothing is done to renew it. Sugar beets will not exhaust the soil more than other heavy crops if the right methods are pursued. It should be the aim of every farmer growing sugar beets to make a profit out of them, the same as any other crop; therefore, he should be careful in the selection of land for growing them. If a piece of land is not adapted to general cropping, avoid it for sugar beets. Put upon it something better adapted to it, and operate, if possible, in such a way as to make it productive. If it is wet and sour, drain it. If light, put it in grass or build it up with legumes in rotation with light crops and liberal applications of barn-

yard manure. At least do not try to reclaim it with sugar beets. They are not a good reclaimer.

Beets are an expensive crop at the best and should be put upon lands offering the best opportunities for good yields. It takes 6 to 7 tons of sugar beets per acre to pay the actual cost of production, and it is the tonnage of beets over and above this amount that yields the profit. So it can readily be seen that poor land should be planted to something whose production is not so expensive. On poor land sugar beets are liable to produce a loss, either in low sugar content and purity or small tonnage of beets per acre.

A prospective sugar-beet farmer has a great many facilities at the present time for posting himself in this respect. Sugar-beet growing is becoming quite general throughout the various parts of the United States, and it is quite probable that he can find some one in his neighborhood who has practical knowledge of the subject. If not, the factories are constantly publishing literature containing directions for growing beets, selection of the land, and treatment after they are planted. The experiment stations of the various States are publishing bulletins and distributing them free of charge, containing much matter upon these subjects. Every factory has an agriculturist for the express purpose of instructing the farmers in the proper methods of growing sugar beets, the selection of lands, and how to treat the different lands in growing this crop. The Department of Agriculture is publishing a great deal of material upon the subject of the beet-sugar industry. All of these publications are available and free for the information of the farmer engaging in sugar-beet growing.

Most farms contain different kinds of soil, which are in different states of availability for cropping, though some of them are equally good in all parts. The land selected for sugar beets must be fertile and susceptible to fine pulverization. The surface and subsoils must be of such a nature as to be easily penetrated by the taproots, laterals, and rootlets.

The land should be as free as possible from the seeds of weeds and grass. However, these can be overcome by sufficient attention and labor.

ROTATION OF CROPS.

A system of crop rotation should be adopted. The best rotation, as a rule, is the one which permits of fall plowing prior to the season of planting beets. This is especially true in sections of the country where the soil is subject to freezing. The proper rotation, however, depends entirely upon the location of the farm and the kinds of crops generally produced in that section.

I have seen sugar beets grown successfully and successively for a series of years, sometimes as high as five, but it goes without saying

that this is not the proper method. Usually the results of such farming are bad. It should be the aim of the farmer to thoroughly fertilize the ground during the cycle of rotation. This is usually considered most favorable for beets if done a year or two prior to planting of the crop. Always start with the best land, and bring other lands up to a better state through rotation, cultivation, and fertilization before planting to beets. In this way beets eventually increase the productiveness of the whole farm.

PREPARING THE LAND FOR THE SEED.

Preparing the soil properly for growing sugar beets is another important feature, and comes next to the selection of the soil itself. We must consider all the different important steps necessary in growing a beet crop. A failure in any one of them, or a lax or loose method, may result in disaster or loss. Having determined to grow the crop, no pains should be spared in doing it right. Everything depends upon doing each part thoroughly and faithfully. The preparation of the seed bed proceeds differently under different conditions of soil and climate.

There are two things, however, that apply generally: (1) Deep plowing, and (2) minute pulverization by surface harrowing. Often it is necessary to subsoil while turning the land with a stirring plow. I have seen many instances where this has not appeared beneficial, many instances where it has appeared to be actually harmful, and many more where it has been absolutely necessary. Where winter freezing obtains, fall plowing is usually preferable, if possible. In the first place it catches the summer and fall crop of weeds and grass and turns them under, thus eliminating some of the difficulties of cultivation during the growing of the plants. In the next place fall rains or irrigation dampen the soil, and the upheaval through freezing mellows it and makes available certain of its elements of fertility.

After the land is plowed, it should be thoroughly pulverized. This may be accomplished in several ways—by harrowing, dragging, planking, and rolling. Whatever local system is used most successfully in accomplishing this purpose is the most desirable. The idea is to pulverize the soil, and this is an important matter. The sugar beet is, in its early stages, a tender plant, and, while the soil should be fine, at the same time it should be moist and in such a condition as to be thoroughly compact about the beet ball, filling in the convolutions of its outer parts. This is desirable because it enables the ball to absorb moisture, which promotes the germination of the seed. If the surface is left in a lumpy or cloddy condition, many of the balls remain in open spaces allowing free circulation of the air, and, instead of being moistened, they are dried up and the germs killed.

Sugar-beet growing is garden culture on a large scale. It might be

stated in a general way that whatever is applicable in gardening in preparing seed beds for such a crop and in the care necessary to germinate the seeds and sustain the plants in their after growth will apply also to sugar beets. Most of the success of this plant during its growing season will depend upon the proper condition of the ground at the time of planting.

PLANTING AND GERMINATION.

The soil being in just the right condition and containing sufficient moisture to germinate the plant, the seed should be sown with a beet seeder in rows which are 16 to 20 inches apart, the distance depending on local circumstances and kinds of soil. It is better to use a specially designed beet seeder which is adjustable as regards width of rows and the amount of seed used per acre. The amount of seed usually required is 15 to 20 pounds per acre. The seeds are sown quite thick, the regulation of the amount per acre being governed by the proximity of the seeds in the row.

It is usually anticipated that many more seeds will germinate and come up than are required. This is the insurance part of the performance. A stand of beets is absolutely essential to the success of the crop. The beet seeder can be adjusted so as to plant seeds from a half inch to an inch and a half in depth, according to the kind of soil and its condition as regards moisture, warmth, etc. Care should be taken not to plant too deep. Until experience shall have given him a definite idea of his own, the grower should seek advice regarding the proper depth from some person better posted than himself as to planting sugar beets in his locality.

Some method of compacting the soil around the seed is generally desirable. This is usually accomplished by rolling. The smooth surface left by a roller is objectionable in some localities; for instance, where the soil is sandy and there is much wind, thus drifting the sand against the young beets, cutting them off or injuring them. Under such circumstances the ground is usually "planked." This is accomplished by drawing a platform arrangement made of planks over the soil, which leaves the surface considerably rougher than does the roller.

Care must be used to plant at the right time, the same as with any other crop. This must be determined by the moisture in the soil, its temperature, and the weather.

In from seven to ten days, if the soil is warm and moist enough, the beets will begin to make their appearance. The real struggle on the part of the grower for a crop begins at this juncture. There are several kinds of emergencies that may arise at this tender stage of the plant; a frost or a hailstorm can do them considerable damage, and they may have to be replanted. In replanting, it is not good practice to undertake to reset beets extensively.

This germinating period is the anxious time of the beet grower; a beating rain may crust the surface to such an extent that the beets can not penetrate it. In such cases I have seen valuable results produced by using a harrow to break up the crust of the surface. At every stage of the crop the beets must be kept clean and cultivation must begin at the earliest possible moment. Sometimes they are cultivated soon after planting. These first cultivations are accomplished with special beet cultivators which work several rows at a time. These cultivators are adjustable to the width of the rows, and usually have, for the first cultivation, small, loose, sharp knives running parallel with the surface and designed to cut off the grass and weeds just below the surface.

BUNCHING AND THINNING.

About the time when the beets show the fourth leaf the bunching and thinning process begins. This is necessary to remove the excess of plants, made necessary in order to secure a stand of beets. Single plants should be left in the row from 6 to 10 inches apart, depending on the distance between the rows and the kind of soil. The time of thinning is important. If the proper amount of seed has been used there will be a considerable excess of plants, due to the nearness of the seeds to one another. A still further excess results from the fact that each particular seed contains from one to six germs, all of which are liable to germinate.

It is quite evident that if all the germs in the seed grow we are liable to have a bunch of several plants from a single seed standing very close together, often intertwining and forming a network of rootlets. The longer these plants are allowed to grow in this way the more complex, difficult, and harmful becomes the process of removing the superfluous plants. If this thinning is put off too long it disturbs the position of the plants which are to remain, breaks their tender rootlets, and materially and permanently injures them. Every effort should be made to accomplish this thinning as quickly as possible. A little money spent at this stage proves a very valuable investment in the after stages of the plant. A beet grower should prepare himself beforehand and be ready to accomplish this work and not allow it to drag along. With the best of intentions and preparations, he is liable to be more or less hampered by rains and other difficulties, but he should not fail to exert his best efforts to get his crop thinned as soon as possible after sufficiently matured for this purpose.

The process is known in the common parlance of the grower as "blocking and thinning." Blocking is accomplished by a person walking along the row with a short-handled hoe, sharp and of sufficient width, cutting out part of the beets so as to have bunches the proper distance apart for the plants in the row. Thinning is accomplished

by a person creeping along on his hands and knees, and with a deft movement of the hands and fingers removing all the plants in the bunch except the one his eye selects as the strongest plant. This all requires agility, attention, and industrious and laborious effort; it is in a sense a kind of cultivation, because all the soil is loosened around the plant, and should be compressed around it again with the hand before going on. Grass or weeds growing around the plants should also be removed.

CULTIVATION.

The methods of cultivation are various. The object sought is the elimination of the grass and weeds, the conservation of moisture, and the loosening of the soil around the plant. Beets must be kept clean. By this term in sugar-beet growing is meant more than in corn growing. It is desired that these beets shall be rich in sugar. The sun and air are the great reagents which accomplish this result in the beets. Weeds and grass must be eliminated from the crop in order that this may be accomplished. Beets are a vigorous crop, and they should have the full sustaining power of the soil and not divide it with waste plants and weeds.

After the first cultivation the horizontal blades of the cultivator are replaced with elliptical blades which penetrate the soil three to four inches and loosen it, making a dust mulch which conserves the moisture of the soil and promotes the growth of the plant. The cultivator is usually drawn by a single horse or mule, and is manipulated by a single laborer, who usually cultivates two or four rows at a time.

It can be seen that this part of the work is not particularly laborious. One man and one horse can cultivate many acres of beets in the course of the season. The number of cultivations given to a crop varies according to the exigencies of the case. If it is a dry season cultivation should be continuous in order to maintain a dust mulch and conserve the moisture. If the beets are excessively weedy, hand hoes should be used. The number of times beets should be hoed also varies. The crop should be kept absolutely free of weeds; the ground should be kept soft and in good condition. If the land has become foul, the more hoeing the better the results. If the land is fairly clean but little hoeing will be necessary.

It has never been my privilege to visit Germany or other beet producing countries, but I have been very much interested in interviewing well-informed agriculturists of our own country who have inspected the methods used in the beet fields of Germany, France, and other European countries and compared them with those prevalent here. It seems that there is a wide difference between methods of beet culture employed there and those employed in this country, and the difference is not in our favor. In Germany a plan is outlined for rotation, which

involves the manipulation of the land for a series of years. This land is handled in such a way as to bring about the best results during the different years in the cycle of rotation and for the different cycles planned. There cultivation and preparation of beet fields are more like careful gardening. I grant that this involves some expense. The increased yield, however, and the economy of soil manipulation, induced by its better mechanical condition, very much overbalance the expense.

The cultivation of a beet crop should begin the moment the soil is broken up for planting to beets. If the land is broken in the fall it should be harrowed immediately, possibly rolled. It should be allowed to rest for a while, giving the weed seed time to germinate and come up, then it should be cultivated and harrowed again. In the spring after stirring it should be cultivated and harrowed several times until ready for planting. After planting it should be gone over with a "weeder" or harrow as soon as the weeds and grass begin to appear. These harrowings, etc., kill weeds, conserve moisture, and prevent the soil from baking. A cultivator should be brought into requisition at the earliest possible moment and the services of the "weeder" or harrow continued alternately with the cultivator even after the plants are up. Cultivation should be continuous from the moment the beets come in sight until they become so large that it is impossible to continue.

Good results are just as effective in teaching a farmer as in any other business. When doing things a certain way results in large profits, the farmer is disposed to repeat the operation. In order to procure a good crop of corn, potatoes, or any other cultivated field crop, it is not really necessary that the fields should be absolutely clean. They may be well cultivated and kept ordinarily clean during the growing season, and still a good yield may be secured. But yield is not the only thing under consideration with sugar beets; they must be pure, and high in sugar, and clean cultivation is vitally necessary in securing this end.

These other crops, although producing good yields, offer opportunities for the ripening of considerable weed and grass seed to trouble the farmer in the cultivation of his succeeding crops. When the growing of sugar beets proceeds in the correct way the ground is left practically free from these weed and grass seeds. When the harvester plows out the beets in the fall it is equivalent to another stirring of the ground. Whatever weed and grass seeds remain are turned under, and either germinate in the fall or come up in the early spring and are caught by the stirring plow or the early cultivator of the succeeding crop. If the crop of corn or potatoes follows in the spring, we have a mellow clean field, and the cultivation is very much facilitated. Just as beneficial effects result from having a clean field if wheat, barley, or

oats follow beets. The influence of beet growing upon any other crop for the next two or three years is very decided. By the time this effect begins to diminish the cycle of rotation has run out and we plant beets again, and the crop can now be produced with better results and with less effort than before.

Farmers are not slow to learn the lesson taught by growing sugar beets. A mistake often proves expensive. A valuable fact learned through experience is sure to perpetuate its influence. The following press clippings will show that the lesson of cleanliness in beet growing is having its effect.

The Menominee (Mich.) Leader of November 11, 1903, under the caption "Canadian thistles can't thrive with sugar beets," says:

A use for sugar beets has been discovered by a farmer of Door County which is new, at least to this locality, and which will cause many a farmer to rejoice. This new utility is the extermination of the Canadian thistle, which is a pest to the farmer of this country. A Door County farmer this fall planted a piece of land in sugar beets. An adjoining piece was planted in some other vegetable. On both of these tracts were patches of Canadian thistles. A few weeks later, when the time came for the crops to be harvested, the field in which the other vegetable had been planted was covered with the thistles so thick that the vegetables could hardly be seen, while in the field in which the beets were planted the thistles had disappeared. The farmer says he intends to plant the whole tract in beets next year.

The Leipsic (Ohio) Tribune of May 7, 1903, says:

It is rather surprising to learn that the weeds which are sometimes allowed to grow in the sugar-beet field have the power of stealing the sugar from the sugar beets, or at least of keeping the beets from getting all the sugar they would otherwise acquire. A test to prove this was made at the Nebraska station. On four plats of beets some were left weedy and some were kept clean. Beets from the four weedy plats were analyzed and showed a sugar content of 12.9, 12, 9.8, and 9.2 per cent, respectively. From the four clean plats the beets showed sugar contents of 13.2, 12.5, 11, and 10.7 per cent. In all cases the difference was in favor of the plat that was kept clean. It is true that this was but one experiment, and a great law should not be laid down on a single experiment, but it must be considered as having some weight.

I grant that to the average American farmer, accustomed to growing 160 acres of wheat or small grain, in addition to a large acreage of corn, such an outline of work as this may seem preposterous. I wish to assure any such person that it is the most logical method conceivable. This assertion will be indorsed by many successful beet growers of this country who are accustomed to beet growing in this or a similar manner. The logic of this method is that the yield and superior quality of the beets will pay all this expense and greatly enhance the profits besides. It must be within the experience of every observing farmer that a good stand of any crop is the first requisite of profit at the harvest. Such a stand depends largely upon a proper preparation of the seed bed. It must be just as patent to him that cultivation with

a harrow and cultivator is a great deal cheaper than cultivation with the hoe or by any hand method. It is much easier and cheaper to destroy weeds when they first germinate or while they are young than it is after they have become well established in the soil. It is less expensive to cultivate in the manner above described than in the one ordinarily used, which involves hoeing and hand weeding.

To the person accustomed to his 160 acres this method of cultivation may seem impossible, but I contend that he should not plant 160 acres in sugar beets unless he has a large capital and plenty of labor at hand. For an ordinary farmer 10 acres is considerable. For an extensive farmer 25 acres is a large tract of beets. There are farmers who can successfully grow much more. The acreage should be such that it can be gone over many times with the rollers, cultivators, and harrows. If proper attention is given at the right time and is continuous, weeds can be kept in subjection with very little use of the hoe or hand work. Cultivation of other crops should teach this. Good judgment and carefully matured plans for the accomplishment of these things in the right way at the proper time is of vital importance. When such judgment and such planning are contributed beet growing resolves itself into a task of comparatively easy execution. If the farmer will use these methods and thin his beets at the proper time before they have become too large there can be no question of a good yield. Good judgment is also required in selecting the proper time for planting, when the soil is moist enough and warm enough to thoroughly germinate the seed.

Information and advice on all of these points can be obtained from the agricultural superintendents of the sugar factories. The farmer should not follow his own judgment and then hold the sugar factory responsible for poor results afterwards. His own judgment will be a good guide for him after he has had considerable experience in growing the beets, the same as with other crops. It will then be worth as much to him as anybody else's judgment, if not more, because he will understand better the action of his soil with beets after its manipulation for a series of years. Until such a time arrives he is bound to follow the advice of those especially provided by the factory for that purpose. In fact, as a rule, he should always secure the benefit of the advice and judgment of these factory experts.

When the leaves of the beets touch those of the adjoining rows their shade becomes so dense that the ground ceases to dry out so quickly and the weeds and grasses are overcome and smothered in the race for existence. Too much insistence can not be made on horse cultivation. Often growers stop cultivation at the critical time for its use, claiming the soil is too dry for cultivation. This is the time when it is most necessary. In fact cultivation should be constant. Killing weeds is not the only object; conservation of moisture is

paramount when the season is dry. Cultivators stir the surface much deeper and more regularly than hoeing.

Constant cultivation maintains a dust mulch and breaks up and covers the sources of egress of the moisture, thus holding it in the soil for the plants. Hand hoeing in its place is desirable, but my observations have convinced me that in practice in this country it is unwise and tends to a high cost of production. A proper system of horse cultivation will lead to better results and at a lower cost. No hand hoeing can ever take the place of the cultivator in conserving moisture. I believe that a proper system of cultivation would greatly cheapen the cost of production of beets and greatly increase the tonnage per acre. In fact, I have seen this demonstrated so often on the farms of our successful growers that I am convinced that to unwise and expensive cultivation is due most of the discouragement in sugar-beet growing wherever it exists. I can state it as a general rule that our best yields are not accomplished with the highest cost of production. It is common to see yields averaging 15 to 18 tons per acre in fields alongside of which are others yielding only 5 or 6 tons, the beets being grown from the same seed on the same land, but operated by a different farmer.

HARVESTING.

After the crops have matured the next work of the grower is the harvesting. The time of harvest is usually indicated by the agriculturists of the sugar factory for which the beets are destined, and notice is given to the grower to deliver his beets to the factory. An expert in sugar-beet growing can readily discern when beets are ripe. The leaves droop and take on a yellow cast. The sooner they are harvested after this the better, as they have reached their maximum of sugar content and purity. Warm fall rains are liable to start a new growth of the beets, causing them to send out a fresh supply of rootlets. This has a tendency to lower the purity and sugar content of the beets. If it is apparent that the crop can not be received at the factory at some time in the near future, the beets should be harvested and siloed. The contract usually provides for following the orders of the factory in this respect, and this is the safest course.

Siloing is performed by taking the beets after they are harvested and placing them in piles, covering them with dirt to prevent evaporation and freezing, and increasing the dirt covering as the weather grows colder. There are many methods of siloing in use. The usual one consists of piling the beets in long ricks, pyramidal in shape, with a base of about 6 feet and a height of about $4\frac{1}{2}$ feet. If straw, beet leaves, old hay, or anything of the kind is used, it should be placed on the rick after the dirt. If it is placed on the beets before the dirt, it is liable, by the pressure of the dirt, to adhere to the beets. When

they reach the factory this litter interferes with the further manipulation of the beets; it clogs the ditches, and some of it still adheres to the beets after they are washed and interferes with the slicing. For several reasons it is undesirable to place straw, beet leaves, or the like on the beets first.

There are many kinds of harvesters in use. A very common kind is a long-shanked plow, similar to a stirring plow, with a long, slender share which cuts off the beets about 9 or 10 inches below the surface, and the moldboard throws them over on their side, after which they are picked up. Another very common variety of harvester is an implement in the shape of a plow. Instead of a moldboard it has two shanks, each terminating with a prong like a finger. These are forced through the soil, one on each side of the row of beets, at a depth of about 9 to 10 inches. The opening between the two fingers gradually lessens as the beets pass through the space between them until finally the taproots are broken and the beets are lifted 2 or 3 inches from their position in the soil, whence they are easily extracted by a person following the plow.

Topping is a feature of harvesting which consists in removing the crown and leaves of the beet by a single stroke of a knife in the hands of the operator. It is the purpose of this operator to cleave the beet at the sun line, indicated by the discoloring of that part of the beet just above the surface of the soil. After the beets are topped they are thrown into piles or in wagons or are sacked, preparatory to their delivery to the factory.

The delivery of the beets is accomplished in several ways. Anywhere within a radius of 10 miles from the factory they can be delivered in wagons. A greater distance than this usually necessitates delivery by railroads. There are different methods of unloading the beets, some special method of dumping being usually employed. This is accomplished in some places by dumps at the factory, on which the wagons are driven and attached, and, the horses being detached, the whole load of beets is then dumped into the bins automatically. At other times the wagons are prepared with nets lining the boxes. These are taken up by movable derricks or cranes and swung over the bins, where the nets open and the beets are dropped into the bins. In other places the beets are shoveled out of the wagons in the old-fashioned way with potato shovels or beet shovels.

At other places, where the beet-sugar acreage is grown in different localities, at a distance from the factory, special dumps are built near a sidetrack of a railroad at some point in each locality convenient for the surrounding farming district. Such a dump is elevated and approached by a long incline or tramway, at the lower end of which the beets are weighed and up which the load is driven onto the dumping platform. The horses are detached, and by means of the dump

the whole load is precipitated into a car on the sidetrack below. These are very convenient contrivances, and are becoming quite popular in a great many places. They offer convenience in the delivery of beets by the farmer, greatly lessening the cost of delivery and very much extending the beet-growing area of the factory.

TARE.

Having grown a crop of beets and delivered them to the factory, the next concern of the farmer is weights and measures. There are two methods in use in making payments for beets. One is called the "flat price," by which is meant so much per ton regardless of the sugar content; the other is so much per ton up to a certain per cent of sugar and purity and an additional amount for each additional per cent. This is called the "sliding scale."

Owing to the adoption of the latter method at many factories, the prices of the beets vary from \$4 to \$5.50 per ton. In some States bounties are offered on the production of beets and sugar. Sometimes this bounty is divided between the farmer and the factory, and at other times the factory is given so much for each pound of sugar produced, provided it pays the farmer a stipulated sum per ton for the beets. When the beets arrive at the factory a sample lot from each wagon-load or carload is taken by the factory, weighed, washed, and rendered free from extraneous matter. The clean beets are then reweighed and the amount of refuse and dirt in the sample lot is determined. From this is derived the per cent of tare or waste. This method is continued throughout the delivery of beets from a particular source, or it is continued long enough to determine the average per cent of tare running through each farmer's beets.

Tare has been the bone of contention between the farmer and the factory. It seems that no one has yet hit on a method of determining the tare that inspires confidence and gives satisfaction to all parties concerned. Beets will naturally be more unclean from one kind of soil than from another. Beets from a locality where the soil is wet and sticky will not be so clean as those from a locality which is dry. It ranges from 2 per cent to 20 per cent and higher. These wide differences give ground for considerable controversy during every campaign, and the tare question is the skeleton in the closet of every beet-sugar factory. I have noticed, however, that in factory districts with long experience farmers are learning considerable about the conditions that affect tare and are able to give considerably closer estimates on a wagonload of beets than at the beginning, and the tare question is gradually becoming more of a routine matter.

It is astonishing to see the things that will find their way into the refuse pile of a sugar factory through the delivery of beets—dirt, stones, old iron, old guns, pieces of old implements, and every con-

ceivable kind of débris known in the rural districts. When it is considered that beets are thrown into the conveyances by hand it is hardly conceivable how these things find their way into the bins of a sugar factory. It does, however, suggest that there are two sides to the tare question, and some stringent method of determining the amount is necessary.

THE QUESTION OF FERTILIZING.

In the older beet-growing countries of Europe, where plans are arranged ahead for the manipulation of farms for a series of years, fertilization is one of the things most carefully considered. We are very little accustomed in the greater part of this country to the use of commercial fertilizers. In fact, we are not as much inclined that way as we should be, or as we will in years to come. I wish to insist, however, that we should not fail to resort to those methods of improving our soil now in use by every good farmer in our country, and known to every one, whether he uses such methods or not. This is applicable to every crop, but it is especially so to the beets.

CROP ROTATION AND GREEN MANURING.

I do not advise that the farmer should abandon other crops to grow beets, in fact, under a proper theory of farming, such a thing would be impossible. I do advocate, however, that a farmer should grow beets for two purposes. First, to improve his farm for other crops, and second, for the good profit in producing them. This simply involves the introduction of beets in rotation with other crops. Every farmer should have a plan for the manipulation of his farm for several years in advance. He should balance his stock interests with his crop returns. He is accustomed to growing certain staple crops adapted to his locality. He has done so for some time. He will continue to do so in the future. But there is no reason why he should not broaden his plan, if he has an opportunity to introduce a new crop which will increase his profits and his land. If a sugar factory is located in his vicinity, sugar beets should be introduced into the crop rotation. Probably the main crops have been hay, small grain, corn, etc. In a proper rotation with beets, these follow each other in a logical manner from field to field. If the farmer has properly balanced stock raising against his crop production, he will be able to retire from the business of selling grain to that of feeding his stock for beef, pork, poultry, butter, cheese, and eggs. This enables him to improve his soil with barnyard manure; in addition, it enables him to introduce into the rotation the growing of leguminous plants, the clovers, stock peas, alfalfa, etc.

These legumes during the harvesting years store in the soils nitrogenous elements required by the grains, and in addition after a few

years he is enabled in the fall to plow under the second growth of the green crop of clover, pease, etc., and this serves as a valuable fertilizer. There are places where plowing under of this green crop is not practicable. I submit, however, that it is very desirable in most of the States where beets are grown under rain conditions and where the lands receive considerable freezing in the winter. Such methods as these are within the reach of almost every farmer growing beets and should come more generally into use than at present. The sugar beet should not be the rival of other crops, but should be their ally in logical cooperation on the farm. We need more careful attention to systematic rotation and fertilization.

MEANS AND METHODS OF INCREASING SOIL FERTILITY.

Methods of fertilizing the soil for the beet crops are largely on trial in this country. That some fertilization is desirable goes without question, but in practice very little fertilizer is used. It seems necessary, therefore, to emphasize this question here. We have been so accustomed to growing all kinds of crops without fertilizers, reclaiming wild lands and continuing them in cultivation and cropping without any reenforcement, that this question has not come home to us as seriously as it has to the people of older countries. Even if we possess abundant virgin fertility in our best lands it will only be temporary at most; we are simply drawing on the future. The sooner we begin some systematic system of fertilizing the better it will be for the soil.

One of the fixed charges of cropping in the old countries, especially in the sugar-beet districts, is for fertilizers. In Germany sugar beets are grown on land worth from \$200 to \$800 per acre. In a cycle of rotation it costs to fertilize the land from \$12 to \$25 per acre. Crop earnings there have to be distributed upon such high values of land and fertilization that the people of this country possess a real advantage in this respect in the growing of sugar beets in competition with the farmers of those old countries. A sugar-beet crop is one that will justify the investment in fertilizer.

The methods and systems of fertilization are so various and so dependent upon the character of the soil that it is hard to outline any particular kind. The requirements of the soil are like those of animals. They can not all be fed alike. There is a lack of some of the elements of plant food in some soils and an overabundance of other elements present in both the available and nonavailable state. Fertilizers promote plant life directly, and some indirectly, by breaking up compounds and freeing elements of plant nutrition which enter into other available compounds.

It is a truism to say that soils need a balancing up of the things needful. This is especially true of the silt soils of the mountain States

and the Pacific coast. The deficiency is best supplied by the introduction of commercial fertilizers. Many of our soils are lacking in humus; they may be rich in mineral plant foods, while at the same time they are poor in mechanical structure. Such soils need to be reinforced by the compost heap and by decaying vegetable matter. Without humus they dry out and become hard and sterile. Moisture is the agent of solution and circulation, the solvent and common carrier of plant food.

Many soils are deficient in nitrogen, which is supplied both through commercial fertilizer and decaying vegetable and animal matter. Barnyard manure offers a ready means for fertilizing the soil, and one which every farmer can employ. Much has been said and written upon this subject, and with a common accord favorable to its use. There has been considerable difference of opinion, however, as to the time and methods of its application for beets. I think much of this disagreement is due to the different requirements of the various soils. Probably barnyard manure is good for all kinds of soil on which sugar beets are grown. As to the time of its application I do not care to make a suggestion, except that the farmer should experiment with his soil, study the action of similar soils, and follow his best judgment. Any farmer can largely increase his supply of barnyard manure by a methodical effort. I wish to call attention to the helpfulness of a sugar factory in this particular. Through the pulp produced by it and beet leaves and beet tops left in the fields the sugar factory makes possible a large increase in the number of animals kept on the farm. These by-products afford abundant food forage and stimulate animal production.

The farmer takes a load of beets to the factory and takes home a load of pulp. He gathers his beet leaves or stores them or mixes them with pulp, in a silo made for that purpose. Both the pulp and the leaves are good for young animals, fattening animals, and dairy cows. The barnyard manure should be carefully preserved and taken back to the land, increasing the humus and supplying nitrogen and other plant foods. The sugar factory has extracted the sugar, which is not a part of the soil's fertility. Assuming that he returns all of the manure resulting from feeding, the pulp from his beets, and the beet leaves of the crop, he has returned to the soil again all the fertility appropriated by the beets, except that assimilated by the animals. The farmer has intensified the productiveness of his lands and increased the profits of cropping. Every city or town affords a supply of barnyard manure. The citizens are glad to get rid of it. They will give it away and sometimes they will pay for its removal. When a farmer takes a ton of beets to the factory he receives only a half ton of pulp in return. He will be able only to bring home half as many tons of pulp as he delivers tons of beets. But he need not return empty handed; he can

return half the time loaded with barnyard manure and distribute it on his farm. In this way he can haul a load from as well as to the factory, thus largely reducing the net cost of delivering the beets.

I have talked with thoughtful, progressive, and successful farmers who claim that a special trip for the average distance the farmers haul beets to the factory, made for the sole purpose of procuring manure from the towns of the vicinity, is highly profitable. If this be true, then in case he can return to the farm with a good load of manure after unloading his beets, it virtually costs him nothing to deliver a load of beets to the factory.

EXPERIMENTS WITH COMMERCIAL FERTILIZERS.

The Department of Agriculture has conducted experiments for several years past for the purpose of determining the value of various kinds of fertilizers on sugar beets. Last year, at the suggestion of the Secretary of Agriculture, a number of similar experiments were carried through on a somewhat larger scale than heretofore. In these experiments 10-acre fields of uniform soil were selected and divided into two equal parts. On one part 500 pounds of fertilizer per acre were used, while no fertilizer of any kind was used on the other. A ton of the fertilizer prepared for these experiments consisted of—

	Pounds.
Superphosphate.....	1, 100
Sulphate of potash	400
Dried blood.....	500
	<hr/> 2, 000

This mixture was used in Michigan, Utah, Colorado, and Washington States as representing to some extent the several sugar-beet sections. In several cases no reports of results were obtained, but the experiments reported upon showed a decided increase in tonnage, due undoubtedly to the action of the fertilizer. In addition to the increased tonnage, the beets on the fertilized soil contained more sugar and a higher coefficient of purity than the beets on the unfertilized soil. In one instance where a sandy loam was used the returns from the 5 acres that were fertilized amounted to \$291.32, while the 5 acres that were not fertilized produced but \$144.63 worth of beets, a clear gain of over \$100 from the use of fertilizers on 5 acres of beets.

It is the desire of the Secretary of Agriculture that similar experiments be conducted again this season on a still more extensive plan. Accordingly arrangements are now in progress for repeating these experiments in ten of the sugar-beet States, using several kinds of fertilizer. From two to fourteen experiments of this nature will be carried on in each of the ten States, and it is confidently expected that this work will so encourage the growers of sugar beets that they will hereafter be enabled to obtain larger returns for the money and

labor invested in sugar-beet production. In some sugar-beet sections the growers have already learned the value of good fertilizers and assert that they would not attempt to grow this crop without the application of plant food to the soil.

EXPERIMENTS WITH BARNYARD MANURE AND COMMERCIAL FERTILIZERS.

As throwing light upon the advisability of manuring a plat of ground used in growing sugar beets the same year they are planted, I offer the results of some very interesting experiments conducted by the State experiment station at Geneva, N. Y. These experiments were conducted for the following purposes: (1) Testing the results on the quality of beets grown on land to which stable manure has been applied in the spring prior to the crop; (2) testing the quality of the beets in comparison with beets grown on land receiving no manure; (3) testing beets grown on land receiving commercial fertilizer, compared with those grown on land receiving stable manure. On the plats receiving the commercial fertilizer, 1,000 pounds per acre was used; on plats receiving barnyard manure 40,000 to 80,000 pounds per acre was used. In either case beets gave better results with barnyard manure.

In growing beets it has been generally believed that it is a bad practice to apply fertilizers, especially barnyard manure, in the spring of the year of cropping. These experiments seem to show the reverse of this proposition. They were published in Bulletin No. 205 of the State experiment station at Geneva, N. Y., December, 1901, a portion of which bulletin is here quoted:

GENERAL PLAN AND CONDITIONS OF THE EXPERIMENTS.

The experiments were planned with reference to comparing the composition of beets grown with commercial fertilizers and those grown with stable manure applied in the spring just before planting. Check plats have also been used in order to ascertain how the beets would grow without the application of any manure whatever. All the experiments have been conducted on the station farm excepting in the year 1898, when one set was carried out on the farm of F. E. Dawley, Fayetteville.

Excepting the year 1899, when texture conditions were unfavorable on some of the plats, owing to a lack of rain at the time of germination of the seed, the beets were successfully grown, both as to quantity and as to the type and healthfulness of the plants.

The stable manure used was a mixture of that coming from the cow and horse stables of the station, sufficiently composted and mixed to render it fine and of uniform composition. The manure actually applied to the beet soil was analyzed only one year, 1901. Manure from the same general source and used in another experiment was analyzed in 1897, 1898, and 1899. From the data thus secured it is possible to know approximately the amount of plant food supplied to the crops from this source.

Composition of manure made in the station stables.

Year.	Water.	Nitrogen.	Phosphoric acid.	Potash.	Remarks.
	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	
1897.....	73.9	0.389	0.360	0.342	Used on corn.
1898.....	76.1	.363	.241	.593	Do.
1899.....	74.3	.529	.576	.851	Used on wheat.
1901.....	78.3	.445	.382	.738	Used on beets.

In 1901 the manure was applied at the rate of 80,000 pounds per acre; in all other years at the rate of 40,000 pounds. The commercial fertilizer mixture was essentially the same throughout. Its ingredients and approximate composition are given in the following table:

Fertilizer mixtures used on sugar beets.

Material.	In 1 ton.	Containing approximately—		
		Nitrogen.	Phosphoric acid.	Potash.
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
Acid phosphate.....	900		126	
Sulphate of potash.....	300			150
Dried blood.....	400	40	8	
Nitrate of soda.....	400	60		
Total.....	2,000	100	134	150
In 1,000 pounds of the mixture.....		50	67	75
In percentages.....		5	6.7	7.5

EXPERIMENTS OF 1898.

These were carried on both on the station farm and on the farm of F. E. Dawley, Fayetteville, N. Y. The plats were one-twelfth acre at the station and at Mr. Dawley's one-sixteenth acre. In the tables which follow the yields are given for 1 acre

Commercial fertilizer on sugar beets, 1898.

Amount of fertilizer used.	Yield of trimmed and washed beets per acre.	Sugar in beets. ^a	Coefficient of purity of juice.	Average weight of beets analyzed.	Place of experiment.
<i>Pounds.</i>	<i>Pounds.</i>	<i>Per cent.</i>		<i>Ounces.</i>	
0	20,425	15.2	85.2	16½	Station.
500	21,375	15.6	85.7	16½	Do.
500	27,140	14.5	86.0	15	Do.
1,000	26,928	14.4	83.6	16	Do.
1,000	26,250	14.7	85.4	17	Do.
1,500	23,822	14.3	84.5	15½	Do.
1,500	27,920	14.9	85.8	16½	Do.
2,000	22,073	15.0	85.6	13½	Do.
2,000	27,875	17.0	87.1	12½	Fayetteville.
0	18,585	15.4	81.6	9	Do.
0	17,740	17.2	85.0	14½	Do.
500	23,373	15.2	77.1	16½	Do.
500	24,075	14.3	79.8	13½	Do.
1,000	24,220	14.5	78.3	10	Do.
1,000	24,220	15.9	81.3	18½	Do.
1,500	26,890	15.3	80.1	13½	Do.
1,500	26,330	15.2	79.7	.....

^a The percentages of sugar in the beets as given in these tables are the results of actual determinations on the basis of a weighed quantity of beets and are not calculated from the sugar in the juice.

Summary showing effect of fertilizers on yield of sugar beets in 1898.

Fertilizer used per acre.	Number of experiments.	Yield per acre.			
		Lowest.	Highest.	Average.	Increased average.
<i>Pounds.</i>		<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
0	3	17,740	20,425	19,294	-----
500	4	21,375	27,140	23,990	4,696
1,000	4	24,220	26,928	25,405	6,111
1,500	4	23,822	27,920	26,240	6,946
2,000	2	22,073	27,875	24,974	5,680

Summary showing effect of fertilizers upon percentage of sugar in beets in 1898.

Fertilizer used per acre.	Number of experiments.	Amount of sugar in beets.		
		Lowest.	Highest.	Average.
<i>Pounds.</i>		<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
0	3	15.2	17.2	15.9
500	4	14.3	15.6	14.9
1,000	4	14.4	15.9	14.9
1,500	4	14.3	15.3	14.9
2,000	2	15.0	17.0	16.0

Summary showing effect of fertilizers upon coefficient of purity of sugar beets in 1898.

Fertilizer used per acre.	Number of experiments.	Coefficient of purity.		
		Lowest.	Highest.	Average.
<i>Pounds.</i>				
0	3	81.6	85.2	83.9
500	4	77.1	86.0	82.1
1,000	4	78.3	85.4	82.1
1,500	4	79.7	85.8	82.5
2,000	2	85.6	87.1	86.3

Results of applying stable manure in growing sugar beets, 1898.

Amount of stable manure applied per acre.	Yield of trimmed and washed beets.	Sugar in beets.	Coefficient of purity of juice.	Average weight of beets analyzed.	Distance between beets in row.	Place of experiment.
<i>Tons.</i>	<i>Pounds.</i>	<i>Per cent.</i>		<i>Ounces.</i>	<i>Inches.</i>	
0	20,425	15.2	85.2	16½	8	Station.
20	25,360	18.5	85.2	12	6	Do.
20	29,340	17.2	86.2	13	8	Do.
20	28,690	16.4	86.7	15	10	Do.
20	27,100	15.7	85.2	11	6	Do.
20	28,354	16.2	85.7	12½	8	Do.
20	28,680	17.2	87.4	13	10	Do.
20	29,656	17.8	86.4	11	6	Do.
20	29,533	17.9	87.7	14	8	Do.
20	31,944	17.7	87.8	12	10	Do.
0	16,050	14.4	77.8	13½	8	Fayetteville.
0	18,022	15.5	82.0	16	8	Do.
20	23,514	18.2	81.3	8½	8	Do.
20	25,625	15.7	78.8	11½	8	Do.
20	24,780	13.1	78.0	14½	8	Do.
20	25,485	14.3	79.0	11½	8	Do.
20	27,094	15.2	80.3	15½	8	Do.
20	26,750	17.9	87.5	12½	8	Do.

Summary showing effect of stable manure on yield of sugar beets, 1898.

Amount of stable manure used per acre.	Number of experiments.	Yield per acre.			
		Lowest.	Highest.	Average.	Increased average.
<i>Tons.</i> 0 20	3 15	<i>Pounds.</i> 16,050 23,514	<i>Pounds.</i> 20,425 31,944	<i>Pounds.</i> 18,730 27,450	<i>Pounds.</i> 8,720

Summary showing effect of stable manure on percentage of sugar in sugar beets, 1898.

Amount of stable manure used per acre.	Number of experiments.	Amount of sugar in beets.		
		Lowest.	Highest.	Average.
<i>Tons.</i> 0 20	3 15	<i>Per cent.</i> 14.4 13.1	<i>Per cent.</i> 15.5 18.5	<i>Per cent.</i> 15.1 16.6

Summary showing the effect of stable manure upon coefficient of purity of sugar beets, 1898.

Amount of stable manure used per acre.	Coefficient of purity.		
	Lowest.	Highest.	Average.
<i>Tons.</i> 0 20	77.8 78.0	85.2 87.8	82.6 84.2

EXPERIMENT OF 1899.

This was similar in plan to those of 1898 and was conducted on the station farm. As before stated, the crop was a failure on part of the plats, owing to a failure of the seed to germinate. Only on the check plat and the plats to which farm manure was applied was there a uniform stand of plants. Because of lack of rain at critical times the crop was reduced below the normal. The seed was sown June 1, and the crop was harvested November 22. The plats were one thirty-sixth of an acre in area. To avoid error, 20 beets from each plat were analyzed.

Sugar beets grown with stable manure, 1899.

Plat No.	Stable manure applied per acre.	Yield of trimmed beets per acre.	Sugar in beets.	Coefficient of purity.	Average weight of beets.	Distance apart of beets.
	<i>Tons.</i>	<i>Pounds.</i>	<i>Per cent.</i>		<i>Ounces.</i>	<i>Inches.</i>
11	0	15,840	14.8	84.2	10	.....
12	20	25,200	14.9	83.9	8	6
13	20	23,400	15.7	85.9	8.7	8
14	20	21,960	15.1	85.7	10.4	10
15	20	22,320	15.4	83.3	8.7	6
16	20	22,320	15.5	84.6	9.5	8
17	20	21,020	16	86	11.2	10
18	20	23,940	15.8	86.9	7.7	6
19	20	21,800	16.3	88.1	10.3	8
20	20	22,680	15.8	90.2	11.7	10

Summary showing effect of stable manure on the yield and composition of sugar beets, 1899.

Barnyard manure per acre.	Yield of beets per acre.	Sugar in beets.	Coefficient of purity.	Distance apart of beets.
<i>Tons.</i>	<i>Pounds.</i>	<i>Per cent.</i>		<i>Inches.</i>
0	15,840	14.8	84.2	-----
20	23,820	15.4	84.7	6
20	22,507	15.8	86.2	8
20	21,887	15.6	87.3	10
		<i>a</i> 15.6	<i>a</i> 86.1	-----

a General average for manured plats.

EXPERIMENT OF 1900.

In the experiments of this year three varieties of beets were grown, the seed of which was supplied by the United States Department of Agriculture. Each variety was planted in triplicate plats with commercial fertilizers and the same with stable manure. The time of planting was June 4, and of harvesting November 23. The dimensions of the plats were 165 by 6½ feet. Twenty beets from each plat were analyzed. The results appear in the following tables:

Results from manuring sugar beets, 1900.

No. of plat.	Variety of beets.	Yield trimmed beets per acre.	Sugar in beets.	Sugar in juice.	Coefficient of purity.	Average weight of beets analyzed.
	Plats with commercial fertilizer, 1,000 pounds per acre:	<i>Pounds.</i>	<i>Per cent.</i>	<i>Per cent.</i>		<i>Ounces.</i>
1	Vilmorin's Improved White.....	42,568	-----	15.9	83.6	19
2	White Queen of the North.....	39,629	-----	16.1	84.8	20
3	Austrian Special Kleinwanzlebener.....	38,822	-----	14.6	81.6	18
4	Vilmorin's Improved White.....	40,051	13.4	15.8	83	18
5	White Queen of the North.....	35,635	14.9	16.6	84	18
6	Austrian Special Kleinwanzlebener.....	37,171	14.2	15	84.4	17½
	Plats with farm manure, 40,000 pounds per acre:					
7	Vilmorin's Improved White.....	41,895	-----	16.1	83.7	21
8	White Queen of the North.....	38,077	-----	17.6	85.2	19
9	Austrian Special Kleinwanzlebener.....	40,550	-----	15.7	84.3	19
10	Vilmorin's Improved White.....	43,968	15.5	16.8	86.2	18
11	White Queen of the North.....	38,784	15.4	17.5	83.9	19
12	Austrian Special Kleinwanzlebener.....	44,851	14.7	16.1	85	20

Summary showing effect of manure upon the yield and composition of sugar beets (by varieties), 1900.

Varieties and manures.	Yield per acre.	Sugar in beets.	Sugar in juice.	Coefficient of purity.
Commercial fertilizer, 1,000 pounds per acre:	<i>Pounds.</i>	<i>Per cent.</i>	<i>Per cent.</i>	
Vilmorin's Improved White.....	41,310	13.4	15.8	83.3
White Queen of the North.....	37,632	14.9	16.3	84.4
Austrian Special Kleinwanzlebener.....	37,963	14.2	14.8	83
Stable manure, 40,000 pounds per acre:				
Vilmorin's Improved White.....	42,681	15.5	16.4	85
White Queen of the North.....	39,430	15.4	17.5	84.5
Austrian Special Kleinwanzlebener.....	42,700	14.7	15.9	84.6
General summary:				
Beets, with commercial fertilizers.....	38,979	14.2	15.6	83.6
Beets, with stable manure.....	41,604	15.2	16.6	84.7

EXPERIMENT OF 1901.

The seed of the two varieties of beets came from the United States Department of Agriculture. Each variety was planted in duplicate on both commercial-fertilizer and farm-manure plats.

Results of manuring sugar beets, 1901.

Plat No.	Fertilization.	Yield of beets per acre.	Sugar in beets.	Sugar in juice.	Coefficients of purity of juice.	Average weight beets analyzed.
	Seed—Department No. 6395, Meyers's Frederickswerter:	<i>Pounds.</i>	<i>Per cent.</i>	<i>Per cent.</i>		<i>Ounces.</i>
1	80,000 pounds stable manure per acre....	40,710	13.2	14.9	78.1	13.7
2	1,000 pounds commercial fertilizer.....	36,660	12.3	16.5	83.7	14.2
3	No manure.....	25,226	13.1	17.1	82.9	13.9
	Seed—Department No. 5772, Dippe's German:					
4	80,000 pounds stable manure per acre....	33,570	13.4	18.6	80.0	13.1
5	1,000 pounds commercial fertilizer.....	28,190	15.6	20.7	87.7	12

Summary showing effect of manures upon yield and composition of sugar beets, 1901.

Fertilization.	Yield of beets.	Sugar in beets.	Sugar in juice.	Coefficient of purity.
	<i>Pounds.</i>	<i>Per cent.</i>	<i>Per cent.</i>	
No manure	35,226	13.1	17.1	82.9
1,000 pounds commercial fertilizer.....	32,425	13.9	18.6	85.7
80,000 pounds stable manure.....	37,140	13.3	16.7	79

In this experiment the commercial fertilizer used was similar to that applied in former years, both in kind and quantity, but the stable manure was increased from 40,000 to 80,000 pounds per acre. This was an excessive application of an animal manure, twice as much as most farmers would consider a liberal quantity. Fifty beets from each plat were analyzed. The above tables show the results.

DISCUSSION OF RESULTS.

These experiments, which have been carried through four years, have included the growing of beets from high-grade seed from various sources, at least six different varieties (names) being used. The main question at issue in this work has been the effect of commercial fertilizer and stable manure upon the manufacturing value of the beets, with especial reference to the possibility of depressing the quality of beets by growing them on land to which stable manure has been freshly applied. A determination of the percentages of sugar and of the coefficients of purity has been the means of judging of the quality of the beets grown. No determination has been made of the character of the nonsugars present in the juice. If beets may be standardized as to quality by the proportion of sugar in them, together with coefficient of purity, then the conclusions to be drawn from the data herewith presented are plainly indicated, as the following table will show:

General summary of results showing the influence of manure upon the quality of sugar beets, 1898-1901.

Year.	On plats which were not fertilized.			On plats which received commercial fertilizer.			On plats which received stable manure.		
	Sugar in beets.	Sugar in juice.	Coefficient of purity.	Sugar in beets.	Sugar in juice.	Coefficient of purity.	Sugar in beets.	Sugar in juice.	Coefficient of purity.
	<i>Per cent.</i>	<i>Per cent.</i>		<i>Per cent.</i>	<i>Per cent.</i>		<i>Per cent.</i>	<i>Per cent.</i>	
1898 a	15.2	.....	85.2	15.0	.....	85.4	17.2	.....	86.5
1898 b	15.6	.....	81.6	15.0	.....	79.4	15.9	.....	80.8
1899	14.8	16.2	84.2	.....	.....	.....	15.6	17.9	86.1
1900 .....	.....	.....	.....	14.2	15.6	83.6	15.2	16.6	84.7
1901	13.1	17.1	82.9	13.9	18.6	85.7	13.3	16.7	79.0

a On station farm.

b On Dawley's farm.

Attention is directed to the figures of the preceding tables, but more especially to the general summary in the table just given. The data here presented are strikingly opposed to what is regarded as the orthodox method of manuring sugar-beet land. It so happens that, with the exception of the crop of 1901, not only does the stable manure fail to depress the quality of the beets, but the crops grown where it was applied in the spring show a higher percentage of sugar than where commercial fertilizer was used or where no manure was applied. In 1901 the percentage of sugar was but little lower, but the coefficient of purity appeared to drop. But in this case the stable manure was used in an excessive quantity.

SUGAR-BEET SEED.

QUALITY AND SOURCE OF OUR SEED SUPPLY.

The proper selection of the seed is the first requisite in planting. At present most of our beet seed is imported from Germany and France. As with other commodities, there are a few standard varieties, the quality of which is well known. These standard varieties are also in the hands of responsible and established firms. I have known of very serious mistakes in the selection of seed. The entire crop of one new factory in this country was one season produced from seed of a low quality, and with consequences that were serious and far-reaching.

No one can tell much about the quality of seed by looking at it. A farmer can test the seed by germinating a certain number of seeds between two dampened blotters kept warm and moist. He can observe what percentage germinates. As each seed or ball has from one to five germs, there should be not less than 150 sprouts from 100 balls. If, in addition, 80 per cent of the balls sprout, the seed can be considered good from the standpoint of vitality. The best method to pursue with relation to seed is to consult the nearest reliable source of information, such as a factory or an experiment station which is making germination tests.

The standard test usually applied to beet seed is the one called the "Magdeburg test," which is as follows:

The seed should not have in dirt or refuse over 3 per cent.

The moisture of seed should be not to exceed 15 per cent.

In five days 100 balls should produce not less than 100 sprouts.

In seven days 100 balls should produce not less than 125 sprouts.

In fourteen days 100 balls should produce not less than 150 sprouts.

In fourteen days 1 pound of seed should produce not less than 31,818 sprouts.

In fourteen days not less than 80 per cent of the balls should sprout.

The claims of responsibility made by the venders of foreign-grown seed must be taken with a grain of allowance. Some sources of our importations are more reliable than others. It is becoming evident, however, that the mass of seed brought to this country is not up to the standard of that supplied to the European growers. Our factory managements are dependent upon this supply at present.

METHOD OF PRODUCING SUGAR-BEET SEED.

Beet-sugar production can not be carried on successfully in a small way. It requires large capital, extensive equipment, and covers a period of from three to five years. The method of producing the beet seed grown in Europe—that which we import—is practically as follows:

First physical examination.—The grower of the seed starts with a quantity of high-grade seed. This is planted and the resultant beets, before they are harvested, are scanned for the characteristics of high quality as indicated by the size, shape, color, quantity, texture, stem, and placement of the leaves. By these characteristics beets are selected denoting high quality. Some mode is then used to designate the individual beets which have been selected for segregating at the harvest.

Second physical examination.—When the beets are harvested, those whose superior quality was indicated by the leaves are scanned for characteristics of quality shown in the root itself as indicated by size, shape, color, etc.

Chemical test.—In the following spring the beets which passed the two physical tests are taken out of the silo and given a chemical test. This consists in taking out a small portion of each beet, which is analyzed for sugar content and purity. This finishes the examination, and the ones in which high quality has been indicated throughout the tests are selected for “mother beets.”

Mother beets.—These mother beets are planted on very carefully prepared land in rows, and on areas 3 by 3 feet, different varieties being isolated. Each beet has a number or designation that follows it throughout its test and growth.

Mother-beet seed.—The resultant crop of seed from these selected mothers is known as the “mother-beet seed,” and is the seed from which is produced a new crop of mothers for beginning another series of examinations and selections such as I have just described.

“Elite” seed.—The most of this mother-beet seed, however, is used in the production of commercial beet seed. It is planted in rows 12 inches apart, and after the beets come up they are thinned to 24 plants to the foot. This will, of course, produce very small beets—about three-fourths to 1 inch in diameter. These small beets (called Stecklinger) are siloed in the fall. In the spring they are set out in areas 3 by 3 feet. These beets produce the crop of seed that goes into the market, furnishing the seed for the farmers who grow the beets for the factories. It is known as “Elite” seed, or “A” seed. It is the best seed procurable for growing beets.

Second-class seed.—It appears that there is “shoddy” in every kind of business. There is no exception in beet seed. The responsible beet-

seed growers of Europe furnish this standard "A" or "Elite" seed to those who call for it. It is much more expensive, but it is the seed that should be used in all cases. The closer akin the seed is to the selected mothers the higher will be the quality of the beets.

There is another class of growers, however, who plant out this "elite" seed and grow another crop of small mother beets similar to the first. These are planted the following spring, producing seed the same as in the case of the first-class stecklinger. This removes this second-class seed two generations from the original selected mother. As without constant selection there is a great tendency in beets to degenerate in sugar and purity, it must be apparent that this second-class seed is very much inferior to the "elite." Much of it, however, reaches this country and is planted, producing many of our crops of beets.

Third-class seed.—There is another class of "growers" (so called) that do not produce seed at all, but who assemble seed much the same as is done in the general seed business in this country. This second-class seed is bought up, mixed with old seed on hand, and disposed of under the advertisement of some "extensive beet-seed grower." It must appear evident that a great deal of care should be exercised, and the selection of beet seed is vitally important to the factories of this country.

HOME-GROWN SEED.

For several years we have been producing seed in a limited way in various parts of the country, especially in California, Utah, Michigan, and Washington. These growers make no chemical tests. Everything is done by physical selection. The indications are that we shall grow a very high quality of seed when this matter is given as careful attention as obtains in Europe, where most of the seed used by us is produced. Even with methods now used by these home growers seed is produced for our growers of beets that in quality compares very favorably with the beet seed imported from Europe. This home-grown seed appears especially strong in germination. This is especially important, as vitality is the main feature in securing a stand of beets. Mr. Morrison, the beet-seed grower in the State of Washington, handed me a memorandum of two tests made on the germination of seed produced by him, in one of which 96 balls out of 100 germinated and in the other 98 balls out of 100. I have collected results of tests made at different factories of the germination of imported seed, and they show that from 53 to 80 balls in 100 germinated. It seems that the imported beet seed from which we grow the beets for our factories runs generally no higher than this.

The beets produced from home-grown seed also show high sugar contents. Below are the results of 185 analyses of beets grown from

seed produced in the State of Washington by Mr. Morrison. These tests were made at the chemical department of the State Agricultural College at Pullman, Wash., October 10, 1903.

Sugar contents of beets from home-grown seed.

	Per cent.
8 beets, average sugar in beet	17. 26
15 beets, average sugar in beet	18. 48
52 beets, average sugar in beet	19. 38
53 beets, average sugar in beet	20. 30
39 beets, average sugar in beet	21. 22
16 beets, average sugar in beet	22. 22
1 beet, average sugar in beet	23. 00
1 beet, average sugar in beet	24. 00
185	20. 21
162 beets, average sugar in beet	21. 69
110 beets, average sugar in beet	22. 15

Some germination tests of sugar-beet seed have recently been made by Mr. E. Brown, botanist in charge of the seed laboratory, Bureau of Plant Industry, United States Department of Agriculture. The results so far secured are shown in the following table:

Germination tests of sugar-beet seed by Bureau of Plant Industry.

Test. No.	Name of grower.	Name of variety	Duration of test in days.	Sprouts from 100 balls.	Per cent of balls giving sprouts.	Sprouts from 2½ pounds.
12703	Dippe Bros. (foreign)	"Dippe"	6	159	63.5	79,400
			14	175	71	80,600
12735	Vilmorin-Andrieux Co. (foreign).	Vilmorin Improved.....	6	152.5	76	82,160
			14	160	77.5	(a)
12756	Utah Sugar Co. (home grown) .	Lehi, Utah	6	94.5	44.5	66,800
			14	102.5	51.5	71,200
12790	Agnew Bros. (home grown)....	Agnew, California	6	90	43	40,400
			14	97	48.5	41,800
12838	No record of grower (foreign) ..	Hoerning, improved Kleinwanzlebener.	6	197.5	81	81,200
			14	214	87.5	89,600
13007	E. H. Morrison (home grown)...	Kleinwanzlebener Original.	6	193.5	96.5	96,800
			14	203	97.5	93,600
16981	Rabbethge & Giescke (foreign) .	.....do.....	6	182.5	89.5	64,000
			14	198	85	71,800
16982	Christ Mohrenweiser (foreign) ..	.....do.....	6	160.5	77	77,400
			14	169	79	88,800
16983	Otto Breunstedt (foreign).....	.....do.....	6	145	68	76,200
			14	163.5	74	85,200
16984	Schreiber & Sohne (foreign) ...	Elite	6	125.5	74	69,600
			14	145.5	81	76,400
16985	W. Ramdohr (foreign) .....	.....do.....	6	63	37.75	29,600
			14	90	49	43,200
16986	M. Knauer (foreign) .....	.....do.....	6	163	75.5	79,800
			14	186	81.5	88,800
16989	Alma Sugar Co. (home grown) ..	No. 1	6	161.5	74.5	83,600
			14	180	80	91,600
16990	.....do	No. 2	6	161	85	71,400
			14	179	89.5	80,000
18235	E. H. Morrison (home grown) ..	Kleinwanzlebener Original.	5	201.5	89.5	89,800
21457	.....do .....	.....do.....	4	169.5	79.5	92,200

a Not given.

It should be noted that tests Nos. 18235 and 21457 were for five and four days, respectively, and not six and fourteen days, as were all the others.

It will be seen that on six and fourteen day tests the Washington seed grown by Mr. Morrison, with whom the Department is cooperating in sugar-beet seed breeding, excels each of the other seeds in every respect, with the exception of the number of sprouts in fourteen days from the Hoerning seed, and it excels that in every other respect.

I believe the average sugar content of beets in this country can be increased 2 to 3 per cent when we shall have developed a higher strain of beets through home-grown seed. On account of the higher vitality of the germ these experiments indicate that we would have a race of beets more vigorous from the start.

To a close observer in the beet fields the vitality of the seed as shown by germination is an important factor. It is the first evidence of the probable yield of the crop that the grower looks for. Much depends upon the stand. It is desired that a beet shall fill every place in the row provided for it. It is evident that if every third beet is missing there will only be two-thirds of the plants matured at the harvest. If the rows are 18 inches apart and the beets stand 8 inches apart in the row there will be 312 beets to the row and 138 $\frac{3}{4}$ rows to the acre. If every beet is in its place there will be 43,264 beets to the acre. If these beets average 1 pound there will be 43,264 pounds to the acre, equal to 21.63 tons. If the beets average 2 pounds, which is more nearly the usual size, we will have 43.26 tons per acre. This shows the highest possibility of tonnage per acre when all conditions are favorable and we have a perfect stand. Vitality of seed is a strong factor in reaching this ideal.

The plants should start out strong, vigorous, and healthful. They must send down their taproots vigorously and send out their laterals quickly; this enables them to entrench themselves early in the soil. Plants are like animals—vigor in youth promises much for healthful maturity. Strong vitality or germinating power of the seed indicates this early vigor which will enable the plants to withstand diseases, pests, and drought. The number of sprouting germs in a given number of beet balls and the vigor and rapidity of germination are the tests of this vitality. Home-grown seed indicate a germinating power in a shorter time of 25 to 100 per cent more than those selected from ordinary imported seed. I believe that we are entitled to anticipate 3 or 4 tons higher yield of beets from the use of home-grown highly developed beet seed.

The extraction of refined sugar in this country averages 11 per cent or 220 pounds of refined sugar to a ton of beets. The factory pays the farmer for this sugar \$2.27 per hundredweight while it is still in the beet. If the factory could extract 13 per cent of sugar on account of our perfecting a strain of beets with higher sugar content and purity through home-grown seed, a ton of beets would yield 40 pounds more

sugar, worth at the factory \$1.80. This alone would give the factory 36 per cent profit upon the investment of \$5 per ton for beets. To me this seems quite possible. Home-grown seed to-day offers the most encouraging prospect of insuring the future growth and prosperity of the beet-sugar industry. There are two things involved, (1) vitality of the seed, insuring larger tonnage, and (2) higher sugar content, insuring increased extraction, either one of which will throw the balance of power to the home beet-sugar industry as against sugar produced anywhere else under present conditions. I believe that either the increased tonnage or the greater extraction—the first incident to the greater vitality, the second incident to the higher quality of home-grown seed—would alone be sufficient to insure profit on the cost of sugar production as conditions now stand. Happily the higher tonnage would redound to the farmer's benefit, while the greater extraction would benefit the factory.

As to the quality, the farmer must depend largely upon the responsibility of the parties furnishing him the seed, as he does with most other things at which he is not an adept at testing quality. By quality in seed we refer to the germinating power and tendency to produce beets of higher sugar content and purity. The sugar in the beet is so well understood as to need no explanation. By purity is meant the absence of certain other solids aside from sugar usually found in beets in the form of salts of different kinds. There is a wide range in the amount of these salts found in beets grown in different places and under different circumstances.

It must be understood that originally the sugar beets were vastly different from those of to-day. When they were first used in the manufacture of sugar they were considered of good grade if they contained as high as 6 or 7 per cent of sugar. Purity coefficients running from 70 to 80 were regarded as good. Now the purity of the beets throughout the beet-producing districts of the United States runs from 80 to 96 per cent. The sugar contents of the beets grown around many of our factories, especially in Colorado and the Pacific States, will average in sugar contents throughout the campaign as high as 17 per cent. During the past season I have received reports from many parts of the country—western Kansas, Nebraska, Colorado, and California—of individual beets which have tested as high as 25 per cent of sugar.

The sugar beet of to-day is the creation of the practical scientist. It is one of the best examples we have of plant evolution through human effort. People are generally aware that the highly developed, beautifully formed, and finely veined domestic animals of to-day are simply the result of human intelligence exercised in selection and breeding. Certain desirable qualities are noted in an animal, and his race is

closely culled for specimens showing these qualities, and these and their progeny are bred for generations for these points until an ideal specimen is produced. This has been the method of breeding sugar beets. The propagators of this product have greatly increased its content of sugar and its purity through selection and breeding. From the original sugar-beet progenitors, with averages of 6 and 7 per cent sugar, they have progressed to averages of 16 and 17 per cent sugar, with a maximum in the United States of 25 per cent.

What the farmer desires in seed is vitality and sugar-producing quality. He should be careful regarding the source of the seed and in testing the same. The factories usually supply the seed. Their interest in good seed is coextensive with that of the farmer.

WORK DONE BY BUREAU OF PLANT INDUSTRY.

The following preliminary report on the experiments in producing and testing American grown sugar-beet seed has been prepared by Dr. B. T. Galloway, Chief of the Bureau of Plant Industry, United States Department of Agriculture, for publication as a part of this report:

In the spring of 1902 the Bureau of Plant Industry began, in cooperation with certain of the State experiment stations, systematic experiments, having for their object the production of sugar-beet seed in the United States. At the same time encouragement was given to such beet-seed growers as had already taken the matter up and were producing the seed in commercial quantities. During the season of 1903 sugar-beet seed was produced in California, where one grower harvested about 20 tons, all of which was taken by a local factory; in the State of Washington about 40 tons of seed were produced, and in Utah there was a production amounting to about 40 tons; a total for the United States of about 100 tons. The United States uses about 5,000,000 pounds of sugar-beet seed now and there is a growing demand for high-grade product. In the accompanying statements a brief review of the experimental work of the Department is given, with the idea primarily of calling attention to this matter and with the definite understanding that the work so far is wholly tentative. From what has been accomplished it will be seen that seed of high grade can be produced in this country.

The experimental work begun had for its object the establishment of a strain or of several strains of beet seed specially adapted to American conditions and the demonstration that good seed could be produced, and how to produce it. To this end, plantings were made of some of the best seed that could be obtained, and the best roots were selected from the crop. These roots, individually analyzed, have, during the summer of 1903, yielded the first crop of seed of this experimental series. Of course nothing can be predicted regarding

the results. For the present it must be enough to say that all the mother beets selected yielded over 19 per cent of sugar. The seed harvested will be planted this spring for further selection.

While this work was going on the Department strove to encourage those growers already producing beet seed, both by purchasing its own supply entirely from American growers and by distributing the home-grown seed to be tested in comparison with imported seed.

Seed was secured from growers in four States, California, Utah, Washington, and Michigan, although in only the three first was seed produced in commercial quantities. All these samples were tested by the Department in three places in comparison with selected samples of the best German seed, and in one place in comparison with imported seed furnished by the factory. The tests were conducted at Geneva, N. Y., in cooperation with the New York State Experiment Station, at Holland, Mich., and at Fairfield, Wash., in cooperation with private individuals.

Tabulated statements of the results at these three places are given. In examining these statements it must be borne in mind that the "German" lots 1 and 2 were samples sent to the Department as the best seed and for testing purposes. They represent, therefore, a selected seed. "German" 3 was commercial seed. At Holland, Mich., it was possible to make a comparison with factory-bought seed. That it would be unwise to draw any conclusions from one year's work is clearly shown by the tables themselves, from which it appears that "German" No. 1 stood highest at Geneva and lowest at Holland, Mich., while the Utah seed was highest at Washington and Holland, but fifth at Geneva. These tables are therefore presented merely as the record of the work done. The coming season's work may or may not support the results of the past year. It is, however, not too much to say that there is no longer reason to doubt that good seed can be grown in the United States, since seed that was grown without the scientific care that must be given to this work in the future shows itself equal or superior to commercial imported seed.

Summary of analyses of beets grown at Geneva, N. Y., fall of 1903.

Kind of seed used.	Sugar content.	Purity coefficient.	Yield per acre.	Sugar × purity.	Sugar × purity, × yield.
	<i>Per cent.</i>	<i>Per cent.</i>	<i>Tons.</i>		
German No. 1	17.4	88.1	18.61	15.33	23.68
German No. 2	17.3	86.3	17.48	14.93	26.10
Washington	16.3	84.0	18.10	13.69	24.78
German No. 3	17.1	88.1	15.74	15.06	23.70
Utah	17.1	85.9	15.78	14.69	23.18
California	16.2	85.3	16.29	13.82	22.51
Michigan	15.2	83.2	18.89	12.65	17.57

Summary of analyses of beets grown at Fairfield, Wash., fall of 1903.

Kind of seed used.	Average weight.	Sugar content.	Yield per acre.	Sugar x yield.
	<i>Ounces.</i>	<i>Per cent.</i>	<i>Tons.</i>	
Utah	24.64	18.20	11.25	20.47
German No. 1	18.51	18.74	9.24	17.32
German No. 3	23.36	17.23	9.90	17.06
California	14.64	19.48	7.13	13.89
Michigan	14.72	19.39	7.04	13.65
Washington	11.80	19.70	5.84	11.50
German No. 2	8.53	19.00	5.80	11.02

No purity tests were made, as the spindle secured for the work was found to be inaccurate and the time did not allow the securing of another.

Summary of analyses of beets grown at Holland, Mich., involving a comparison of beets from home-grown seed and from Kleinwanzlebener and Hoerning varieties.

Kind of seed used.	Area.	Sugar content.	Yield per acre.	Sugar x yield.
	<i>Acres.</i>	<i>Per cent.</i>	<i>Tons.</i>	
Utah	0.23	16.0	21.7	34.72
Washington .....	.35	13.4	15.8	21.17
California .....	.33	15.0	11.0	16.50
Kleinwanzlebener. { Grown in same field with Utah		15.6	10.5	16.33
{ Grown in same field with Washington		14.8	13.0	19.24
{ Grown in same field with California		15.0	9.9	14.85
Average for Kleinwanzlebener in 3 fields		15.1	11.13	16.82
Michigan .....	.13	12.5	13.7	17.12
German No. 1 .....	.25	13.1	8.0	10.43
Hoerning (Germany). { Grown in same field with Michigan		13.7	10.0	13.70
{ Grown in same field with German No. 1		12.8	13.0	16.64
Average for Hoerning in 2 fields		13.25	11.5	15.17

The Hoerning and original Kleinwanzlebener were commercial lots as supplied by the factory, grown on same field. The Kleinwanzlebener seed was planted under the same conditions as the Utah, Washington, and California, while the Hoerning was compared with the Michigan and German No. 1.

Besides these tests of several sorts of beet seed, sufficient American-grown (Washington) seed was available for distribution in large lots to a number of factories. Unfortunately not many of these have so far reported on the results, but from such as have been received the tests show that in some places the American-grown seed gave better results than the imported, while at other places the results were not so favorable.

On the whole the results are encouraging, and the Department plans to push this work as energetically as possible.

B. T. GALLOWAY,
Chief Bureau of Plant Industry.

THE QUESTION OF LABOR.

The long line of laborers, stretching across the field shoulder to shoulder, or down on their hands and knees industriously engaged in some phase of the cultivation of sugar beets, presents a picture of industrial activity. The question is often asked, Where is the enormous supply of laborers necessitated by our rapid installation of the beet-sugar industry to come from? This is a question of considerable magnitude. Its solution concerns every sugar factory. As a matter of fact the laborers are to be found, although it seems miraculous at times where they all come from. Channels have been opened between the factory districts and the different sources of labor supply over which recruits rapidly follow one another into the profitable summer employment.

For the past four years the labor supply has been of considerable concern to all industrial undertakings, and especially to the farmers. The sugar industry is helpful in solving this difficulty. Wherever located, it draws laborers to it, and these are constantly drawing others. As a rule farmers do not advertise to secure labor; they simply depend upon local supply. Recently this has been going to the cities. Farm laborers have become scarce and expensive. Sugar factories swell the opportunity for employment and advertise it to the world. Labor seeks it out and the farm is benefited.

When a sugar factory is installed in a community the farmers and farm hands, through experience, become adept in certain features of the work of growing sugar beets. But as their labor is insufficient to supply the demand, other farm laborers are brought in from other districts, and these, too, soon become expert in the work.

FOREIGN-BORN LABORERS.

Living in every city and community throughout the United States are people of foreign birth, Germans, Russians, French, Bohemians, Norwegians, Hollanders, and Swedes, who are skilled in growing beets. Some of these gravitate toward districts in which this industry has been established. These frequently induce their relatives, neighbors, and friends in this country and in the old country to follow them, pointing out that their long experience affords an opportunity of profitable employment.

From southern Europe and the Orient we have another class of foreigners, common laborers attracted to this country by its high wages and demand for such services. While not accustomed to beet growing, they are accustomed to this kind of work and they seek it, soon learn it, and become adepts. They stimulate further emigration of

their friends for this purpose. Under this class come Chinamen and Japanese of the Orient, Italians, Roumanians, Portuguese, and others of southern Europe. They are not only inducing emigration but they are drawing largely from the great volume of foreign population already here, who naturally imitate their friends in seeking employment. Each year widens and extends the avenues for reaching this kind of help both at home and abroad. Each spring witnesses the migration of large numbers of these people from the cities to the beet fields in various sections of the country.

There has been a great tendency on the part of immigrants to congregate in large cities, especially those of the East, which offer opportunities for day laborers. This has a tendency to congest these cities with a large foreign element unacquainted, or not in sympathy, with our institutions. To this influence is generally attributed many of the evils of municipal government in our large cities. The beet-sugar industry tends to draw heavily upon this element and such immigration. It attracts and directs immigrants away from the large cities, and distributes them to all parts of the country; it brings them into contact with the healthful living, the sobriety, and pure air of rural life. This has a tendency to change the customs and habits of the immigrants. It offers opportunities for the new generation to develop industrially, educationally, and morally; it quickens the process of civilization, and helps solve the evils of congested cities. It is the best aid to our assimilation of foreign elements into our body politic.

In this connection some press comments may prove interesting:

The Denver (Colo.) Times, April 25, 1903: Another load of immigrants passed through Denver this morning bound for Fort Collins, to locate in the beet-raising district. There were about 100 in the party, and they traveled in a special train. They were mostly Bohemians and Russians, and came from Topeka, Kans., and Hastings, Nebr. A train load with about 200 on board passed through last week, and the population of Fort Collins is increasing very rapidly. Among the late arrivals in that district are a number of Japanese who will engage in raising sugar beets.

The Bay City (Mich.) Times-Press, April 25, 1903: About 500 Russians from Hastings, Nebr., arrived at Saginaw yesterday from Chicago on a Pere Marquette special train. They are under contract to work in sugar-beet fields in Tuscola and Huron counties and were distributed along the line this morning.

Lincoln (Nebr.) Star, April 24, 1903: The Norfolk and Grand Island beet-sugar factories are making preparations for an extra heavy run this season, and as a result there is a strong demand for labor in the beet fields. Russian and Hungarian peasants make the best laborers for the beet fields, and are eagerly sought after. The beet workers live in cottages erected in the fields, and seldom leave them from the opening of the season until the harvest is over. Whole families are engaged in the work and receive \$20 per acre for the season. Representative Ferrer, of the Grand Island factory, was in Lincoln Monday to contract for the labor of 300 Russians, consisting of men, women, and children who will be taken to the fields next week. A force of 300 has been contracted for at Omaha and are already at work. The companies are still in search of laborers, and will spend more than \$40,000 this summer for beet-field workers alone.

Portland (Oreg.) Oregonian, May 15, 1903: Special dispatch from Lagrande, Oreg.—About 30 Japanese came in from Portland on yesterday morning's train to work in the beet fields of the Oregon Sugar Company, and 120 more are expected to follow soon.

CITIES AND TOWNS AS SOURCES OF LABOR.

Traveling on the trains in the early morning or late in the evening, in a sugar-beet district, one will find whole carloads of children from 9 to 15 years of age going out to their day's work in the beet fields in the adjacent vicinity. This source of supply of labor for the beet fields is something enormous. That it is growing and becoming very popular is evident to everybody familiar with the development of the sugar-beet industry. A child of this age is nimble and quick, and is probably better adapted to weeding and thinning than adults. At first thought, according to American standards, one might be disposed to decry this kind of child labor, but a little experience and observation will suggest many advantages.

It must be remembered that this work begins about the time the schools are closed and continues largely through vacation. In this way it does not necessarily interfere with the education of the young people. In our cities what to do to forestall the evils resulting from idleness of the youth and to inculcate habits of industry and economy are among the most important questions. There are a great many families which can only keep their children in the public schools well clothed and well provided for at a great sacrifice, and really at times it is more than they can do. These beet fields are, as a rule, superintended by those acquainted with the needs and details of child management. At this season the weather is usually mild and the temporary arrangements by means of tents, barracks, and the like are provided against the occasional inclemency of the weather.

Cities and towns are also much concerned about the impecuniosity of many families. Continued poverty often results in "chronic poor" and criminals. It is much better that a child reared under such conditions should be enabled to go out into the fields during three or four months of vacation, and there earn sufficient money to clothe himself and contribute to the support of the family. At home he probably has no opportunity for employment; he ranges the streets in idleness, perhaps in rags; he forms bad habits, cultivates wrong associates, and is generally unfitted on reaching maturity to be a good citizen. In the beet fields he receives from \$1 to \$1.50 per day. My observations have taught me that in practice such employment is often sought by the boys of the best families. I have seen the sons of merchants and bankers spending their vacation in the beet fields. I have talked with parents who have told me that they would rather face whatever evils there are in child labor during vacation in the fields than to face those found in the streets of our cities and towns; that it makes their boys healthful and strong, and gives them an independence and an ambition for

self-support. It inculcates industry and wholesome respect for work, upon which the success of their whole future lives depends.

One can not see these train loads of children spending their vacation in this way and not be convinced that it is a boon to the overseer of the poor, to the charitable societies, and those organized for the betterment and uplifting of child life by inculcating good ideals and proper inclinations and dispositions to industry and self-sustenance. In the establishment of 500 sugar factories necessary for producing sufficient sugar for our annual consumption in this country, can anyone contemplate the hundreds of cities and towns to be affected in this way, and not appreciate the great social influence it will have in the future? In order to give a practical view of this point, as outlined in the public press, some clippings from various newspapers throughout the country, showing the fact and extent of child labor, are given below:

Lincoln (Nebr.) Evening News, December 9, 1903: It has been stated recently that the close of the beet-sugar culture has brought between 600 and 900 pupils back to the schools of the city who have been absent several months. It is an astonishing statement, even though the estimate may be exaggerated. Contemplation of this assertion may enable one to gain some conception of the magnitude which the sugar-beet industry may be made to assume in the economies of this State and section.

Detroit (Mich.) News, May 26, 1903: Forty-five men left Detroit yesterday afternoon for the sugar-beet fields in the vicinity of Flint, under the direction of the Detroit Sugar Company. The men, who were mostly habitués of the river front, will receive \$1.50 per day, boarding themselves, or \$1 per day and board.

Alpena (Mich.) Argus, June 24, 1903: The management of the beet-sugar factory at East Tawas, has secured about 100 boys and girls in this city, to go to the beet fields around Tawas and pull weeds. The dealers in sweetness pay them \$1 per day.

Denver (Colo.) Republican, June 11, 1903: The intention of the court is to assist as many boys as possible to obtain work, and with this in mind, Willard Hatch, of the juvenile court force, will spend several days in the beet-sugar fields of northern Colorado for the purpose of investigating the inducements offered for juvenile employment. An effort is also being made to keep in touch with employers of juvenile labor with a view to obtaining their help in keeping the boys at work.

Lansing (Mich.) Journal, July 22, 1903: Nearly every morning persons passing the city hall or the corner of Ottawa street and Washington avenue are surprised to see crowds of children huddled together, barefooted, and heads almost uniformly covered with broad-brim peak-crown straw hats, styled "Panama." These children are waiting for the farmers' wagons to take them out into the country where they work all day weeding sugar beets. Both boys and girls carry hoes that resemble the common garden variety, only the handle is about one foot long and the blade is about one-fourth as large.

Detroit (Mich.) News, July 17, 1903 (special from Prescott, Mich.): Two coaches filled with children ranging from 12 to 18, have arrived here from Alpena to weed in sugar-beet fields.

Grand Rapids (Mich.) Press, August 22, 1903: Factory to field. Welcome change for boys of Owasso. As beet weeders, hundreds of them are employed all through the summer. Modern methods in sugar industry make room for the children at good wages.

STATE INSTITUTIONS AS SOURCES OF LABOR.

It seems that the managements of State institutions have never devised a labor system satisfactory to our social needs and at the same time conducive to the health, best interests, and necessities of the inmates. I refer more particularly to penitentiaries, other penal and reformatory institutions of various kinds, asylums, etc. Most of these institutions have land of their own or they are in close proximity to a farming district where lands can be had. It has been shown by actual trial that sugar-beet growing is adapted to such institutions and is less in conflict with other labor interests than many other kinds of work done by inmates of such institutions.

These institutions are, wherever practicable, gradually becoming a resource of labor for the sugar factory. It is working out the demands of humanity and at the same time helping supply that of industry.

INDIAN LABOR.

Probably on no other internal question has our Government experienced more difficulty or been more in doubt than in adapting the American Indian to some system of industry. The sugar-beet industry is also solving this problem. Throughout the mountain and coast States beet growing is becoming very extensive. The territory furnishing the beets for some of these factories is reaching up to and into the Indian reservations and Indians are helping in the cultivation of the beets.

Several times the Department of the Interior has been importuned by interested parties to arrange a system by which Indian lands can be irrigated and rented, and the Indians employed on their own lands in the cultivation of this product. In a number of places they are seeking employment of the sugar-beet growers on other lands. In some instances they are actually planting the beets—engaging in this kind of farming on their own hook. There is no other force or feature of civilization more helpful to the Indian than industry. It is the one thing that will draw him into civilized ways and methods. He can be counted on at present as a small factor in swelling the supply of labor in sugar-beet districts. Deeming it of interest to the people of the United States to note this tendency of our Indians to do something remunerative, I have selected the following clipping from the Salt Lake City (Utah) News, May 16, 1903:

In the Bear River Valley, where the population is more sparse, they will employ several hundred Indians from the Washaki Agency, and they will do the work well. In Idaho the problem is more serious. The likelihood is that Blackfoot Indians will be employed there by the farmers, and negotiations are now going on to have several carloads of boys and young men sent up to Idaho from Utah or Wasatch County.

CROP RETURNS AND RENT AND LAND VALUES.

In this subject lies the essence of the farmers' interest in the beet-sugar industry. It is "the meat in the cocoanut." What are the returns and what are the permanent benefits? An attempt will now be made to show the profits of sugar-beet growing. In the beginning, however, it should be stated that farmers, like every other class, are divided into good, bad, and indifferent. The results of sugar-beet growing, more than those of any other crop, depend upon the farmer. We have widely varying results, and not only in a particular vicinity, but even in the same field. Some of this variance will be due to circumstances and emergencies beyond the control of the grower, but it can be set down as a rule that the difference in results under like conditions will depend largely upon the kind of farmer growing the crops. Some farmers will make every preparation necessary; will attend to all the details of preparation; will watch the weather and take advantage of favorable conditions; will thoroughly fertilize the land and carefully cultivate it. Others will neglect many of these things. Such neglect may prove harmful or fatal. A good farmer may make a great success in growing a crop of sugar beets, while a poor one with equal opportunities will make a failure.

There is no crop that responds so readily to good treatment as sugar beets or as surely resents bad treatment. Even when beets are given the best attention it sometimes happens that bad climatic conditions at critical times, such as drought, hail, freezing, diseases, or insect pests, may reduce the crop generally throughout the district to a small yield, say from 5 to 7 tons. Such things are providential, and are beyond the farmers' control. On account of the higher cost of production it is more unfortunate, perhaps, when the sugar-beet crop is thus affected than it is with most other crops.

In the profits yielded I have been impressed with the superiority of sugar beets over any other crop grown in the field. These profits are dependent on three things: (1) The farmer must have a sugar factory for a market; (2) he must have proper conditions for growing sugar beets; and (3) he must be a good farmer. In all efforts to encourage farmers to engage in this industry I have assumed the existence of these three conditions. To the man who is not a good farmer the only advice I can offer is to become a good one. Then only would he be advised to undertake sugar-beet production.

If you eliminate the element of bad farming and the emergencies of bad seasons, we have to deal with the possibilities of sugar-beet growing by successful farmers on land adapted to this crop.

The yield will range easily from 10 to 28 tons per acre, and from that to a possible 40 tons. Ten tons per acre will yield a fair profit; 12 tons a fine profit. The profit on yield above 15 tons per acre simply makes this crop out of comparison with any other field crop. Yet we

have such yields every year in all parts of the country where sugar beets are grown. Often a farmer receives in a season sufficient profit per acre above expenses, including a remuneration for his own work in growing the crop, to pay for the land.

I will offer here a comparison of the estimated results of growing sugar beets with those of growing grain, using as factors per acre the ordinary expense attending the production of sugar beets and the minimum tonnage which should result from good farming. I will use as factors in growing the grain the ordinary accomplishments of a good farmer, limiting him to an amount of land such as he can ordinarily handle by his own efforts. I will compare in the end the net profits of sugar beets with the gross profits of grain.

The beets are supposed to be delivered at the market and the money for the crop to be in hand. The grain is supposed to be ready for the market. I will select 60 acres of land and will suppose that 40 of this is planted in corn and 20 in oats. I take it that this is as much as one man can handle in these two grain crops, in fact about what is generally attempted by the farmer who has besides to look after truck patches and garden and his stock and dairy interests. We will say that the 40 acres will produce 40 bushels of corn per acre; that his 20 acres of oats will produce 35 bushels per acre; that he markets his corn for 40 cents per bushel and his oats for $33\frac{1}{2}$ cents per bushel. His gross returns will be as follows:

40 acres of corn, 40 bushels per acre, 1,600 bushels, at 40 cents per bushel...	\$640. 00
20 acres of oats, 35 bushels per acre, 700 bushels, at $33\frac{1}{2}$ cents per bushel....	233. 00
Total proceeds	873. 00

This represents the value of the farmer's time in growing the crops, the rent of the land, the cost of harvesting, the cost of seed, etc. I will not undertake to estimate the net proceeds, but will leave the farmer to judge by his own experience what part of the gross returns may be counted as net proceeds.

Turning now to the other side of the comparison:

60 acres of sugar beets, 10 tons per acre, 600 tons, at \$5.....	\$3, 000
Cost of growing the beets, at \$30 per acre.....	1, 800
Net returns	1, 200

Comparing results we find that 60 acres of sugar beets have produced in net profits nearly 50 per cent more than the gross returns in the other case. It must not be assumed that one man can grow 60 acres of sugar beets. For the sake of comparison I simply use the number of acres that a single man can handle with these grains. It will require 9 other men to assist this farmer in accomplishing this work with beets, but these men and a compensation for the use of capital employed in paying for labor, as well as the farmer himself, are paid out of the estimated cost of production of the beets. We

have not only a net profit larger than the gross sales of the grains, but in growing of beets we have found that the same amount of land usually employing the labor of one man is capable of employing ten.

There is another fact to be borne in mind here having considerable to do with the profits of sugar-beet growing, and that is the rent and land values. It is a fact that everywhere in the United States where sugar-beet factories are established rent values jump immediately from 50 per cent to 100 per cent. Throughout the Mississippi Valley and the old farming districts of the East rental values range in ordinary farming from \$2.50 to \$4 per acre. The rental values for sugar-beet land is from \$5 to \$10 per acre. Rental values are probably not increased so much in California, but it may be stated that they are always materially increased. The earning power or rent of land is the logical and practical basis of its selling. We naturally anticipate that the value of lands will rise with increased rentals, and this is what happens. They increase immediately from 50 to 100 per cent. This applies to districts devoted to general farming. There are many instances in the West where factories are established on arid lands, worth prior to irrigation from one dollar to a few dollars per acre, useful only for grazing. The effect of a sugar factory under such conditions is to increase land values enormously. We have several cases where farming lands rose in value from 5,000 to 10,000 per cent. Of course this is attributable to the joint influence of new towns and the development of irrigation. The sugar factory is the thing that induces and makes these things possible. Below I give some items clipped from the newspapers illustrating these things in different parts of the country:

The Elyria (Ohio) Chronicle, December 23, 1903: It costs \$30 per acre to produce sugar beets. The average yield per acre throughout the country in 1901 was 9.6 tons. The average yield secured by the more intelligent growers, however, is 12 tons an acre. The factories pay from \$4 to \$4.50 a ton, giving a gross return of \$48 to \$54 per acre and a net profit of \$18 to \$24, which is more than double the average profit on other crops.

Michigan Sugar Beet, May, 1903: The Owosso Sugar Company has engaged the services of Donald Chisholm, of Breckenridge, Mich., as assistant agriculturist. Mr. Chisholm has been raising sugar beets for five years and has had remarkable success. In the year 1900 he raised 10 acres of beets and received for his crop \$803.27. He kept accurate account of all his expenses in raising the crop, charging against the crop \$2.50 a day for team work and the prevailing wages for his own time and that of his family, and after making all these charges he made a clear profit above all expenses of \$47.53 per acre. The same year Seneca Curtis sold his farm in that neighborhood for \$47.50 per acre—3 cents less per acre than Mr. Chisholm cleared in one crop of beets off his land. Land in that neighborhood is now worth \$75 per acre as a direct result of beet growing. The above circumstance is a well-known fact in the neighborhood of Breckenridge, where Mr. Chisholm is well known and highly thought of as a successful farmer.

Flint (Mich.) News, December 16, 1903: Beets paid well this year. Sixty acres in Gaines netted nearly a thousand dollars. George Judson, administrator of the estate

of Thomas Cooney, yesterday settled with the Owosso Sugar Factory for 60 acres of sugar beets he raised on the Cooney farm near Gaines village. The total amount received was in the neighborhood of \$2,600, and after all the expenses were deducted the beets netted about \$950.

Wellsboro (Pa.) Agitator, December 9, 1903: Farmers of Spencerport, Monroe County, N. Y., report that sugar beets paid them \$75 to \$125 per acre this year.

American Agriculturist, New York, May 2, 1903: Cost of producing good sugar beets. Our sugar-beet contest brought out some interesting facts concerning the cost and profits in growing one acre of sugar beets in different sections of the country. A number of these have been noted, but we give below a brief summary of a few of these results:

William Edmiston, Allegany County, N. Y.: Interest on land, \$2.10; plowing, \$3; harrowing, \$3; fertilizers, \$2.81; seeding, \$1.75; cultivating, \$2.80; thinning, \$3.75; harvesting, \$5; total, \$29.21. Received for beets, \$40; value of tops and leaves, \$5; total, \$45. Total expenses, \$29.21; net returns, \$15.79.

W. H. Pillow, Canandaigua, N. Y.: Interest on land, \$6; plowing, \$3.30; harrowing, \$1.20; rolling, 60 cents; fertilizers, \$8.20; applying fertilizers, 90 cents; seed, \$1.25; cultivating, \$11.70; thinning, \$3.85; harvesting, \$20; hauling, \$13.50; total, \$75.50. Receipts for beets, \$68.58; total expenses, \$75.50; loss, \$6.92.

C. E. Chapman, Tompkins County, N. Y.: Interest, \$2.40; plowing, \$2.25; harrowing, \$2.50; rolling, 37 cents; fertilizers, \$7.40; seeding, \$2.37; cultivating, \$4.07; thinning, \$5; harvesting, \$8.75; total, \$35.06. Receipts for beets, \$35; value of tops and leaves, \$5; total, \$40. Total expenses, \$35.06; net returns, \$4.94.

C. A. Geotzman, Wayne County, N. Y.: Interest, \$4.50; plowing, \$1.25; harrowing, etc., 75 cents; fertilizers, \$6.45; seeding, \$1.25; cultivating, \$2; thinning, \$4.25; harvesting, \$10.25; spraying, \$1.05; total, \$31.75. Receipts for beets, \$47.08; value of tops and leaves, \$10.31. Total value of crop, \$57.59; total expenses, \$31.75; net returns, \$25.84.

W. E. Bassler, Schoharie County, N. Y.: Interest, \$6; plowing, \$1.95; subsoiling, \$1.95; harrowing, \$2.10; other preparation, \$3.45; fertilizers, \$18.20; seed, \$1.50; cultivating, \$18.60; harvesting, \$29.95; total, \$83.70. Receipts for beets, \$92.16; total expenses, \$83.70; net returns, \$8.46.

Henry Rednour, Otero County, Colo.: Interest, \$6; plowing, \$3; harrowing, 50 cents; fertilizer, \$1; seed, \$1; cultivating, \$4; thinning, \$10; harvesting, \$12; total, \$37.50. Receipts for beets, \$158.09; total expenses, \$37.50; net returns, \$126.59.

M. G. Anderson, Otero County, Colo.: Interest, \$18; plowing, \$3; harrowing, \$1; other preparations, \$2; fertilizers, \$8.50; seed, \$2; cultivating, \$3.50; thinning, \$9; other work, \$8.42; harvesting, \$23.50; total, \$78.92. Receipts for beets, \$149.23; total expenses, \$78.92; net returns, \$70.31.

Glasco (Kans.) Sun, September 25, 1903: Some figures on sugar-beet growing:

EXPENDITURES.

Rent of land (10 acres at \$10).....	\$100.00
Seed.....	20.00
Spring plowing.....	20.00
Leveling and harrowing.....	10.00
Planting.....	7.50
Cultivating.....	20.00
Irrigating.....	15.00
Thinning.....	50.00
Harvesting.....	125.00
Hauling.....	40.00
Total.....	417.50

RECEIPTS.

215 tons, \$4.75 a ton \$1, 021. 25

PROFITS.

Net profit on 10 acres \$603. 75
 Net profit per acre 60. 37½

Last spring one of the agricultural papers of Chicago offered a number of premiums for the best acre of beets raised for the American Beet Sugar Company's factory at Rockyford. The prizes have recently been awarded, and Mr. H. Rednour, who came here a year ago for his health and bought a tract of land 1 mile southeast of Manzanola, received second premium, the first going to Rockyford. His yield was 66,468 pounds, and his beets tested 18.9 per cent sugar, with a purity coefficient of 83.5, and brought \$158.09. The cost of raising the acre was \$33. The contract price for beets is \$4 a ton for those testing not more than 15 per cent sugar and not less than 12 per cent; for each per cent over 15, 33½ cents. Mr. Rednour had a heavy tonnage and a high sugar content, which do not often go together, and which he thinks is due to the fact that he irrigated his prize acre at night.

Colonies of Germans and Russians are seeking this country to engage in beet culture.

The best form of development in the rural districts is that which tends to better systems of intercommunication between the country and the cities and towns. Through such development business men and farmers are brought into closer relations; cooperative sentiment is aroused; better roads are constructed and maintained; electric railway lines are built; rural free delivery is extended; farmers meet in institutes; telephone service is supplied to farmers.

In no place are such developments more in evidence than in the beet-sugar districts of the West and Middle West. The initial cause of many new projects, such as the building of new short lines of electric and steam railways is the delivery of beets and other crude products to the factory, the carrying off of farm laborers to the country and of sugar to shipping centers. This facilitates and enhances the farmers' interests in every way. The beet-sugar industry furnishes the incentive for these improvements.

One of the first effects of the establishment of a factory is the demand for good roads approaching it from all directions. These are soon found to be an actual necessity, and such roads are immediately and continuously improved. The cultivation of sugar beets requires more complex methods, in which the farmers must have instruction. This calls for meetings and farmers' institutes, the study of special literature on agriculture, addresses by those skilled in the science and practice of farming. The farmer is led into a practical and intelligent study of his own interests. He becomes a better stock feeder, a better breeder, a more systematic producer, and more effective in his business methods.

FACTORY AND FARM IMPROVEMENTS.

The sugar-beet farmer of this country and the manufacturer of beet sugar are in close competition with the beet growers of Europe and

the cane growers of the Tropics. The manufacturer of beet sugar can not succeed without beets. In order to secure the beets he must pay the farmer a price which will insure a reasonable profit in growing them. He is limited in price by the market value of the sugar imported from other countries. This market price of sugar is governed by the cost of production in those countries and our import duties. As a manufacturer he can probably hold his own with those of any country. He is skilled, uses labor-saving machinery, and accomplishes the most with the least effort. It is simply a question with him of beets and a sufficient price for his sugar. He has to compete with the low factory and farm scale wage of Europe and the excessively low coolie wages of the Tropics, and with nature's tropical luxuriance in production in addition. While this is true of every industry in the country, it is especially true of the beet-sugar industry. Our farmers are competing directly with the cheap production of Europe and the coolie production of the Tropics. Notwithstanding this handicap, the amount and extent of our industrial achievements have excited the envy and wonder of the other nations of the earth. Our progress is attributable to our artisan ability, progressive methods, and great activity.

The facts just stated indicate the great importance of improvements in the machinery and methods employed in our beet-sugar factories; also in the implements and methods employed on the farms in producing sugar beets. Many such improvements have already been made, and many others are demanded.

The active campaign of a sugar factory is usually from three to four months. It must not be conceived that the rest of the time is spent in idleness. The factories are thoroughly overhauled in the interim; the talents of the superintendents, managers, and engineers are called into requisition for betterments. The agriculturist engages in plans for securing a greater and better supply of beets; the experience of the past year guides him in selecting farms better adapted and growers more efficient. Public roads are perfected; beet shipping facilities are arranged through the establishment of dumps and side-tracks in the country. Each and every one is at work overcoming the obstacles met in past campaigns.

The status of a beet-sugar factory and that of the farming district surrounding it are undergoing constant and gradual evolution. The lands, the farmers, the factory, and the workmen improve. The whole is tending to a unit of effective cooperation and improvement.

IMPROVED FARM IMPLEMENTS.

Other persons are working on machines for doing the "blocking," trying to invent an implement that can be pulled by a horse and will "block" several rows at a time. Others are designing seeders for

planting the beet balls, so that the plants will come up in bunches in the rows at the proper distance, thus doing away with the necessity of bunching or blocking altogether.

We are constantly improving the cultivators, seeders, and other implements used in the cultivation of the beet crop. In many sections of the country the steam gang plow is brought into requisition for stirring the land. Out in the arid part of the country especially we have large tracts of land brought under the influence of the irrigation ditch that are especially adapted to the use of this implement. It plows deep and gets the land into proper condition as soon as possible under the weather conditions. Those in use at Fort Collins, Colo., are of about 40 horsepower, having drive wheels 6 feet high and tires 30 inches wide, each engine drawing 8 plows which, combined, turn over a strip of ground 8 feet wide. They use two shifts of men, work twenty-four hours a day, and can plow from 45 to 50 acres. In the big sugar districts of the Hawaiian Islands, this is the method of stirring the ground. These steam plows are now in operation in different parts of the country, and undoubtedly will be employed in sugar-beet growing.

Considerable has been said as to cultivating beets, and this is one of the principal items of cost. Every farming district in which beets are grown is constantly cheapening this cost in many ways. The matter of harvesting and delivering beets to a factory is also an expensive item. Improvements in the methods of doing this are also being made. New harvesting implements are being constantly devised for getting the beets out of the ground. There is not a sugar-beet district in the country that does not have one or more people working upon some new device for harvesting beets. The old method has been simply to plow the beets out of the ground with an ordinary plow, or pronged device; then the tops are removed by hand. The "Yankee" is trying to discover some method of pulling, topping, cleaning, and loading them by the use of a single implement. Some parties are working on an implement not so complex as the above, designed simply to pull the beets and top them. I have examined many of these improved implements in operation and think there are practical objections to all yet invented. I am convinced, however, that some of them will eventually be perfected, and that we shall have a harvester that will pull the beets, top them, clean them, and load them. When this is accomplished we shall have materially reduced the cost of harvesting beets, and, therefore, the cost of growing the crop.

SLICING STATIONS AND PIPE LINES.

We have two factories in the United States that have done away with the necessity of delivering most of their beets either by wagon or railroad. They have buried pipe lines in the ground, extending

from the factory 12 to 25 miles. These connect with slicing stations, where the juice is extracted from the beets, and milk of lime is then added to the juice for the purpose of preservation. The limed juice is then forced to the central factory either by gravity or by pumping. The first factory adopting this method was the one at Lehi, Utah. The next one is the new factory at Sugar City, Idaho, under the same management. We can conclude, therefore, that this method of transportation at Lehi must have been a success. I take it that it is especially desirable where beets are grown in different valleys accessible to the factory but too far distant for wagon delivery, or where good roads can not be procured or facilities for railroad shipping at the time of harvest are insufficient or cost too much.

The practical benefit to a farming district of having a slicing station connected by a pipe line with the central plant is about as great as that of having a full-fledged sugar factory itself. They have short delivery of beets and the pulp for stock feeding, and these are the main advantages.

IMPROVEMENT IN DELIVERY OF BEETS.

The factories are working out many things to facilitate the delivery of beets. The architects, mechanical engineers, and superintendents of beet-sugar factories are working on improved devices and methods for placing beets in the bins at the factory. It is no uncommon sight at factories having none of these improved devices, but depending upon ordinary shovels, or something of that kind, to see large processions of teams and wagons loaded with beets standing in line waiting for their chance to unload. That this adds cost to the farmer is apparent. Some device for doing away with this extravagance should be installed at every factory. Systematic saving of time demands an arrangement permitting the farmer to drive in and immediately unload. He should be permitted to dump his load into the bins without delay and return home for more. Some factories have dumps by the beet bins, into which cars are run on a sidetrack and a carload of beets is precipitated by a sudden incline of the dump. An effective car and wagon dump, reasonable in cost, is one of the great demands of every sugar factory; it offers a field for people with inventive genius. I feel like suggesting that the National Association of Beet Sugar Manufacturers should offer a prize to anyone who can meet this emergency.

The wagon bed for the use of the farmer in delivering the beets also receives considerable attention. The question is, Can we accomplish this work of dumping the beets at the factory better by having a specially devised wagon? Can we arrange a stationary tramway with trapdoors through which the beets can be precipitated into the bins by removing the bottom of the bed or by removing the end gate and tilting the wagon so that the beets will slide into the bins? The point

is to unload the beets by a single movement and in a short space of time. There are several such devices, but they are expensive. It is a problem worthy of the efforts of anyone of mechanical genius, and whoever will invent a successful device which is not too expensive will be well remunerated.

Anything that tends to lower the cost of producing beets benefits the factory by encouraging the farmer to grow the beets. A few years ago a factory built a tramway reaching up to a dump handy to a sidetrack out in the country for the purpose of facilitating the delivery of beets in a certain section of farming country. This proved beneficial and satisfactory. The farmers had been unable to deliver their beets to the factory by team, and it was too expensive to haul them to the nearest town and ship them by rail. The dump was placed over the sidetrack and equipped with a pair of scales. A man in charge took samples and tagged them. This factory found that it could very much extend its beet-growing territory in this way, and others were built. Now we have sugar-beet dumps in factory districts all over the country, and they are being utilized also by the farmers in unloading other crops.

EXTRACTION OF SUGAR FROM MOLASSES.

When sugar beets are delivered to a factory, they usually contain of sugar from 12 to 18 per cent of the weight of the beets. The factory through its processes is able to extract of white refined sugar from 9 to 13 per cent of the weight of the beets. The amount of this sugar procured depends upon the purity of the beet and the efficiency of the process of manufacture. There is generally a loss of from three to five points. A method for extracting all or nearly all of the balance is a matter of careful experiment at every sugar factory. Its accomplishment means a great saving and a consequent lowering of the cost of production.

The most of this loss passes off in the form of waste molasses. This molasses contains from 45 to 60 per cent of sugar, the other constituents being the extraneous matter making up the original impurities of the beets. The difficulty in extracting the rest of the sugar lies in the impurities present. These have been concentrated in this waste product and interfere with the process of further extraction.

To secure this sugar in the waste molasses requires additional and different processes. Many of our factories are equipped for continuing this work and securing most of the sugar in the molasses. Some of them dispose of it as a waste or by-product. To secure this sugar requires an additional and especially equipped department for that purpose. There are several methods in operation, among which are the Steffen and the osmose. At first our factories feared that the extra

sugar would not pay for the effort, but most of the older factories are gradually equipping themselves for securing this sugar, and the newer ones are generally installing additional machinery for this purpose. Gradually they are working toward a cheaper and more effective method for overcoming this loss.

Slowly improvement is taking place in farming and factory facilities and conditions. Whatever improvement is made results in the general benefit of all concerned. In the aggregate these benefits are considerable. It is evident that there are many lines throughout which the sugar industry is perfecting and entrenching itself. We are to-day producing only a small portion of the sugar we consume. In building new factories we are constantly reducing the balance imported from other countries. As the lines of competition draw closer our factories will be better equipped for emergencies.

BY-PRODUCTS AND THEIR USES.

The most effective sources of improvement, however, of the beet-sugar industry is the utilization of the by-products, not only those of known value, but those to be developed. The utilization of the pulp alone, when it shall have become a staple article of animal food everywhere, will materially increase its market value and decrease the cost of production of sugar.

It has been stated by one in high authority, who has closely investigated the question of by-products, that in the future the manufacturers of beet sugar will look chiefly to the by-products for his profit in the industry. I take it that this statement is rather for the purpose of assurance than as a statement of fact. I believe, however, that the possibilities involved in the question of by-products will so lessen the cost of production that the sugar industry will be able to maintain itself, no matter what the exigencies of the future.

The genius of the American people is a resource of no little importance in establishing the beet-sugar industry in this country. To it we are indebted to-day for our high position in the world's commerce. We are meeting successfully the handicap imposed by the cheap labor of competitors largely through superior artisan ability. The cost of labor in production is against us. This is a fixed feature and is due to the fundamental principles of our institutions, which are founded upon the rights and the welfare of the individual.

Though we pay higher wages, we are constantly developing more effective methods. Conservation of materials and forces is the law of our development. A few years ago the meat industry involved a great deal of waste. Every particle of the animal now conserves some purpose and is carefully preserved. The offal and blood find their way into market as a valuable fertilizer, the hoofs as glue, the horns as ornaments. The hides are transformed into robes or tanned for

leather; the hair has commercial value. The carcass itself is served in many forms on the table, and from it are prepared tonics, tinctures, and nutrients. Every particle of the animal serves some purpose, supplies some of the needs of man.

The beet-sugar industry is now in the formative period. It is developing under the influence of the scientific mind and the practical eye. Its avenues of usefulness are being opened, and the uses of its incidental crude products.

BEET PULP.

In my last report I entered into an extensive discussion of this subject. My purpose here is to reiterate claims regarding the value of this by-product to the stock feeders of this country. The number of beet-sugar factories is growing very fast. They are widely scattered over the country. They are entering new fields whose farmers are unaware of their beneficial effects. Too much can not be said or written on the subject of pulp feeding and its benefits to the farmer. A great deal is being lost at present by the failure of the farmer to appreciate the value of pulp as food for their animals. It is the leading by-product of the sugar factory, and is accessible to every farmer delivering beets. To waste it is as extravagant as to allow other crops to lie in the field and rot; even more so, because they would at least serve the purpose of fertilizing the ground. Yet in many parts of the country the pulp largely goes to waste.

There is a wide difference in the experience of the different sugar factories of the country in regard to disposing of the pulp. Some of them have to give it away; others sell it at a nominal price; some, especially those in the East, dispose of it readily to experienced feeders of by-products at as much as \$1 per ton. Often a sugar factory is established in a district where live stock is not extensively fed, and part of this waste can be attributed to this fact. The pulp by-product is of sufficient importance, however, to induce an increase of live-stock production.

In the older beet-sugar countries of Europe the beet pulp is as much of a boon to the farmers as a crop of sugar beets. Every pound of pulp is carefully preserved and fed, and it is sought after by everyone rearing animals. It is taken fresh from the factory by the farmers who live near by and fed to stock. In other factories it is prepared by drying, placed on the market, and shipped to all portions of the country. It is a staple article of feed everywhere. We can confidently look forward to such a state of things in this country when our farmers shall have become convinced of its value. But the present waste of pulp makes our progress in this direction seem slow. The business world is taking hold of this resource, and large companies are organizing in different parts of the country, advertising the

merits of the beet pulp and shipping it to all parts of the country. In sections where beet-sugar production is going on extensively and where other industries yielding by-products have existed for a considerable time the farmers and dairymen appreciate the merits of by-products as feed for their stock. In such places a factory usually finds a market for all its pulp.

There are plenty of people who appreciate the value of pulp and would use it providing it could be secured. These companies are looking up these sources of demand and shipping to considerable distances. Gradually the farmers near the factories are becoming more experienced in its use, and eventually we shall have the same sort of demand as obtains in Germany and France. In the West, where extensive cattle companies have hitherto depended upon grazing, pulp feeding is proving a boon. Corrals are being built, and thousands of head of cattle are being fed pulp and alfalfa. It is much easier to secure the attention of a large feeder of cattle, or a dairyman with a considerable number of cows, than an ordinary farmer. They study the economies of their business; cheap and nutritious feeds are matters receiving special study; a few experiments convince them, and the result is that they feed pulp exclusively. The small feeder is conservative, and not given to especial investigation. He follows old methods, and is more slow in adopting progressive ways. He should at least imitate his more progressive and responsible neighbors engaged in animal industry. If it is profitable and desirable for men feeding extensively to ship pulp and feed it to their animals, the farmer or small feeder who lives near the factory should at least give pulp a trial.

There is scarcely a factory in the West that has not installed corrals for feeding large numbers of cattle, sheep, etc. The experiment stations of the States in which beet-sugar factories are located have made exhaustive experiments covering the subject of feeding pulp; have entered into the details of cost and profit as compared with other feeds, and have published the same in bulletins for free distribution. Anyone desiring such publications can obtain them by simply applying to the director of his State station.

There is not an herbivorous animal on the farm that will not readily eat pulp if given an opportunity; there is not one that will not be greatly benefited by it. It is good for horses, cattle, and sheep, and it is especially desirable for brood animals and dairy cows. It is a food that can be easily stored and kept, and instead of deteriorating it actually improves with age. It can be kept for several years if necessary. This is not usually necessary, but the fact is mentioned to demonstrate its lasting qualities.

Its hygienic effects appeal for it as much as its nutritive value. It is especially desirable in a food ration made up largely of grains and dry forage. If received directly from the factory, it is moist; if it is

served in the dry state, it must be moistened like bran before it is used. The universal verdict of those long experienced in the use of pulp is that its sanitary qualities are very beneficial. It is not only nutritious in itself, but it stimulates digestion and makes the nutritive elements of other foods more available. It is a common observation of those feeding pulp in a ration with grain that there is a more nearly complete digestion of all; the animal is more vigorous and healthful and more susceptible to improvement from what he eats. It is not suggested here that pulp should be fed alone, any more than any other article of feed. The animal should be furnished a sufficiency of the different elements of food to uniformly build up his physical structure and supply his various needs. The thing desired is a balanced ration. Fresh pulp is a succulent food, and is a mechanical agent in the progress of digestion. The amount that should be fed depends largely upon the purpose of the feeder, whether for growth, maternity, fattening, milk producing, or simply for sustenance.

The amount of pulp entering into a ration is largely one of experiment. Usually it is necessary in beginning the feeding of pulp to graduate the amount on a sliding scale. If it is desired to fatten, the amount should be gradually increased until near the close of the feeding period, when the amount should be gradually reduced. The gradual increase is necessary to adapt the animal's system to this new food and the gradual decrease to harden its flesh and secure the best qualities of carcass. It is the verdict of the best feeders in this country that a fattening animal should be given a liberal supply of succulent feed in its rations. This may be accomplished by grazing, or by feeding root crops, or pulp from the factory. An animal so fed gives a better carcass, the meat being firmer to the touch, more salable, more juicy, and possessing a higher flavor. This element of succulency in the ration of an animal is the secret of success in the Scotch and English feeders in the production of their fine steaks, roasts, and chops. Their example is being successfully followed throughout this country in producing meats of a higher quality to-day.

When it is considered that the pulp can be procured in many places convenient to the feed yards of the farmer for nothing, and many other places at 10 to 35 cents per ton, the suggestion of its use is emphasized. It is a common custom for a farmer to return home with a load of pulp after delivering the beets to the factory. If it is to be used immediately, it is simply piled in a convenient place and fed as desired. That for future use is placed in a silo. The most common silo for beet pulp is a large slanting trench dug in the ground, the walls of which are made of lumber, brick, or cement. Some system of drainage is desirable. After a time siloed pulp undergoes a change by fermentation, the same as any other silage; most people prefer the fermented pulp to the fresh. Any sort of covering, such as hay, straw,

or boards, will complete the means of preservation. The pulp can then be drawn upon at will for stock feeding.

I have seen pulp simply thrown upon the ground and preserved for three or four years without any considerable deterioration, except in the outer part. A silo can be built above ground with boards if desired. Some sort of protection is preferable to none at all.

As to its utility and preparation for feeding by the farmer, I will insert a couple of letters from practical farmers appearing in Bulletin No. 193 of the Michigan Experiment Station, issued in November, 1901, which are as follows:

VICKSBURG, MICH., *August 20, 1901.*

MR. C. D. SMITH.

DEAR SIR: In reply to yours of the 12th, I would say that I have fed beet pulp for two winters and like it very much. A year ago last winter I fed it to 56 head of steers, commencing about the 1st of December. I mixed meal with it. I weighed a few of the steers the 30th of each month. They made an average gain of 70 pounds a month until the pulp was all gone, which was the last of February. The next month we increased the meal a quarter, and they only gained 49 pounds on the average. Last winter I fed it all winter and up to May. I fed 20 cows and 10 steers, feeding all the pulp they could eat, with meal. My steers did well, but I did not weigh them to see how much they gained. I did not feed very heavy of grain, one basket of broken corn going to 10 head twice a day. I believe the pulp to be splendid for cows, as it keeps them in a thriving condition. When I started to feed it in November, I was milking 12 cows, and the third day they had gained 76 pounds in their milk. I fed nearly or quite 250 tons last winter and never had my cattle do so well.

Yours, truly,

W. R. SOUTHWORTH.

DIRECTOR C. D. SMITH.

DEAR SIR: To 45 steers which I was carrying through the winter last winter I fed 3 cubic yards daily of beet pulp. The steers were fed during December, January, and February. They were fed fodder corn, stalks and all, that would go about 35 bushels of ears to the acre. While no weights were taken, the steers showed by their general appearance that they were growing rapidly and doing finely. I noted in the spring, however, that when the pulp was removed the steers did not look so well as they had, nor did they do as well on the grass as when confined to dry fodder supplemented by pulp during the winter.

Our cows certainly gave at least 3 to 5 quarts of milk daily more when fed pulp than they did when we could not get it. Moreover, they did not consume nearly as much other coarse fodder. To 100 ewes I gave nothing but pulp through November and December, while the ewes were running on the meadow. After the holidays I fed drilled corn, but I am sure they did as well on the pulp alone as they did on the corn. I have 130 lambs from the 100 ewes. The lambs are strong and vigorous, and are growing finely.

Yours, truly,

THOMAS FITZGERALD.

In the States of Colorado and Utah one of the main agricultural crops is alfalfa, or lucern. The experiment stations of both States have been making extensive experiments with the beet pulp in a ration with alfalfa and their ordinary grains. In my last report I gave the results of some similar experiments in Colorado. The purposes of

these Utah experiments were to derive the comparative value of pulp with other feeds and the cash value based on the extra yield of milk, butter, and meat. Below I reproduce the report of a pulp-feeding experiment published in Bulletin No. 82 of the State experiment station of Utah, as follows:

For the last two winters feeding experiments have been carried on by this station to ascertain the value of beet pulp and beet molasses as food for sheep and steers. In a feeding test made with the sheep two years ago, the results of which are reported in Bulletin No. 78, sugar-beet pulp and sugar-beet molasses gave profitable returns. When lucern and pulp were fed, 1 pound of gain was made from 7.95 pounds of lucern and 17.86 pounds of pulp; 100 pounds of increase was made at a cost of \$2.48, and pulp had a value of \$1.86 per ton. When lucern, grain (one-half screenings and one-half bran), and pulp were fed, 1 pound of gain was made from 4.23 pounds of lucern, 1.56 pounds of grain, and 10.14 pounds of pulp; 100 pounds of increase was made at a cost of \$2.28, and pulp had a value of \$3.38 per ton. These results agree with the results obtained in the last feeding experiment, namely, that the greatest profit comes from feeding lucern and pulp to sheep when a small amount of grain is added to the ration. Pulp fed in limited quantities with lucern or lucern and grain did not give as good results as when similarly fed ad libitum. When lucern, bran, and molasses were fed, 1 pound of gain was made from 8.1 pounds of lucern, 1.5 pounds of bran, and 1.43 pounds of molasses; 100 pounds of increase was made at a cost of \$2.59.

In the feeding experiment carried on last winter the steers and sheep that received only lucern and beet pulp made the smallest gain per day, and of all lots they required the most dry matter per pound of growth, but gave the largest profit. The steers made 1 pound of gain from 11.5 pounds of lucern and 31.4 pounds of pulp, at a cost of 2.8 cents. The sheep made 1 pound of gain from 16.6 pounds of lucern and 36.7 pounds of pulp, at a cost of 3.8 cents. Pulp when fed ad libitum with lucern to steers had a value per ton of \$1.85, and when similarly fed to sheep it had a value of \$1.13. One hundred pounds of increase with steers on a full ration of lucern and grain (one-half bran and one-half shorts) cost \$4.93. One hundred pounds of increase with another lot of steers of no better feeding quality on a full ration of lucern, grain, and pulp cost \$3.98. One pound of gain was made from 7.2 pounds of lucern, 3.2 pounds of grain, and 17 pounds of pulp. Pulp had a value of \$2.06 per ton. When a full ration of lucern and pulp was fed with a half ration of grain, 1 pound of gain was made from 9.2 pounds of lucern, 2.03 pounds of grain, and 19.1 pounds of pulp; 100 pounds of increase cost \$3.51, and pulp had a value of \$1.66 per ton. When a full ration of grain and pulp was fed with a half ration of lucern, 1 pound of gain was made from 4.28 pounds of lucern, 3.65 pounds of grain, and 21.3 pounds of pulp; 100 pounds of increase cost \$3.84, and pulp had a value of \$2.54 per ton.

The above results indicate that the greatest profit is secured when lucern and pulp are fed ad libitum with no grain or a minimum of grain (one-half bran and one-half shorts). Molasses in small quantities (4 pounds per animal per day) fed with 8 pounds of grain per animal per day and with pulp ad libitum had a value of \$2.35 per ton.

Mr. Hans Larson, a feeder at the Logan sugar factory, feeds thousands of sheep for shipment to the Pacific coast every winter. His feeding operations are financially successful, and he values beet pulp at \$2.50 per ton. Lucern and beet pulp are fed ad libitum regularly twice a day in well-drained open yards, and only such quantities are given as will be eaten up clean in a few hours. All animals have constant access to salt and water, and are bedded with straw during the coldest months. Good drainage of yards and plenty of bedding should always be provided if possible, as heavy pulp feeding produces a very laxative condition.

Much more feeding of sheep and cattle should be done in the vicinity of beet-sugar factories by farmers than is now practiced. Because of its high percentage of water, beet pulp could not be profitably transported long distances. One ton of pulp contains about 1,800 pounds of water. On account of its succulency and carbonaceous character it is a most valuable food for winter use and makes an excellent supplementary food to lucern and the grains.

Pulp keeps well in the open air in large piles, but in small piles it may freeze, which injures its food value. It has a strong offensive odor during early fermentation, and therefore it should not be stored near dwellings or near where live stock is kept. Fermentation seems rather to improve than injure it. If subsoil drainage is good, pulp may be stored in pits and covered with some kind of straw or litter, but not with barnyard manure.

In feeding beet pulp the best practice is to begin with a small quantity per day and gradually increase until the desired number of pounds is reached, taking several weeks for it. There is more danger of feeding too much at first than too little. When too much is fed, animals get off their feed and scour, but straw added to the ration will help obviate this trouble. The feeding should begin with 1 or 2 pounds per head per day for sheep and hogs and 10 or 15 pounds per day for cattle. Along with grain and dry forage sheep will take per head per day from 2 to 10 pounds, cows 30 to 50 pounds, and steers 40 to 80 pounds.

Pulp may be fed along with concentrates to hogs in small quantities, but as it is not naturally suited to this class of animals the quantity fed should be small. For swine, pulp should not be depended upon too largely, for to them as a single food it is only a maintenance ration. Animals will take rapidly to pulp if it is mixed with grain. The amount of pulp fed per day should be reduced toward the close of the fattening period, especially if the animals are to be shipped long distances to market.

Sheep should be dipped for scab two or three times at intervals for two weeks before being put into the feed lot; otherwise most profitable returns may not be obtained. When steers are to be fed a considerable length of time they should be dehorned, as it makes them more tractable and docile. Dry and comfortable, but not necessarily warm, quarters, constant access to salt and water, regular feeding, and kind treatment are essential if most profitable results are to be obtained.

DRIED PULP.

Dried pulp is prepared for the market usually in a subsidiary plant at the sugar factory. The preparation consists in driving off the moisture under a high temperature in a specially arranged kiln. A ton of beets usually produces half a ton of what is known as wet pulp. After the sugar is extracted from the beets the residue is either carried out to the pulp dump or it is run through a press which extracts part of the superfluous water. If pulp is allowed to stand in a dump or in a pile it naturally drains to considerable extent, thus ridding itself of superfluous liquid the same as in the press. This is the only preparation the pulp that is generally fed in this country receives. It is fed extensively in this form in the older countries of Europe. This is known as fresh pulp, and is about 90 per cent water.

Pulp is also extensively dried in Europe and becomes an article of ordinary commerce in use everywhere. If pulp is to be shipped to any distance it must of necessity be dried in the battery or kiln. It is kept under high temperature and in motion, and comes out reduced

in moisture to about 4 per cent. This process of drying has eliminated from it a very large part of its useless weight and has concentrated its nutritious elements.

Dried pulp has about the same protein content as corn, that is to say, its muscle-producing qualities are about the same. The first advantage of dry pulp is largely a mechanical one; it can be sacked and delivered to all parts of the country without the extravagance of freight charges on waste material. It is a very profitable animal food, taking the place of bran, oil meal, and other by-products used as feeds. It can be baled, compressed, and shipped long distances. In this form it extends the market for the pulp output of the sugar factories. It is depended upon and utilized everywhere by everybody. It is becoming quite customary in the older beet-sugar countries in preparing dried pulp to mix with it the waste molasses, forming a combined dried molasses-pulp stock food. The sanitary effect of this combination is considered excellent. The molasses contains ingredients tending to the healthful laxity of the animal. It also contains considerable sugar, which is now being extensively used in feeding animals. Much is said and written upon the value and effect of sugar in an animal's food ration. It is especially considered desirable for work horses and roadsters.

The amount that should be fed depends largely upon the animal and the purposes of feeding. All the scientific food rations of Germany contain either this dried molasses-pulp food or fresh pulp. The amount is designated and differs with the size and kind of animal and the purpose of feeding.

All the waste molasses not otherwise disposed of in some profitable manner is consumed in this way. It can be readily seen that the sugar industry in this country will greatly profit when a like practice obtains here. I have before me a number of reports from people who have been feeding to animals the waste molasses from the beet-sugar factories, especially to horses, spreading it over their feed. The verdict seems to be unanimous in its favor. It would be much more practical to use it as a mixture with dried pulp. The proper proportions can be more easily maintained at all times and the results are better.

The factories of this country have just begun to experiment with the preparation of dried pulp. The sugar company at Alma, Mich., installed a plant three years ago. They have been carefully investigating the subject, experimenting with their dried molasses-pulp product, and determining the proper combination of the two ingredients. Last year they prepared and marketed their entire output of pulp and molasses in this form. It proved a popular stock food everywhere, and other factories in Michigan are now installing plants to work these by-products in the same manner. In other parts of the country factories also contemplate installing plants for preparing

stock food composed of these by-products. The one at Alma, Mich., announced that 15 tons of wet pulp should be reduced to 1 ton of this stock food. Each ton of the mixture should contain 360 pounds of sugar. We have companies organizing in Michigan and Wisconsin for the purpose of advertising and handling this preparation who are trying to introduce it to the market. This, with the general tendency of farmers and feeders to use more and more pulp, will finally consume the entire supply of all the factories.

I reproduce here an article which appeared in the Michigan Farmer May 30, 1903, referring to the product of the Alma factory; also the report of A. W. Wright, a large feeder living in Alma, Mich., as follows:

Colin C. Lillie says: Several days ago we fed the last of the car of dried molasses-beet-pulp. I intended to order some more so I would not get out, but neglected to do so and now have to feed high-priced bran in its place. But the cows will not eat the bran—they do not seem to like it. They would come up every night and morning when they had beet pulp, but now the man has to go after them. It seems to me this is the best test, so far as palatability is concerned, that we could get. The pasture is good and yet the cows ate the pulp clean night and morning. Now, on the same pasture they care but little about the bran and many refuse to eat it at all. It is the same story again with the horses; they eat the pulp readily, but the bran as a substitute they do not seem to like. I am more and more convinced that dried molasses beet pulp is a good thing; all kinds of stock like it and they will do well on it.

At first thought one would think that this pulp would certainly not be good for horses at heavy work, and yet my experience is that they will do well on it. It contains about 18 per cent sugar and here I think is where its great food value lies. Sugar is a good food, and in the form here found it is a cheap food. Besides, this food has a cooling effect in hot weather, and it keeps the bowels in good condition.

A. W. Wright, Alma, Mich., says: During the past winter I fed 100 tons of dried molasses beet pulp to my steers, cows, sheep, and horses, and am highly pleased with the results obtained. I shall use more of it next season.

BEET LEAVES AND TOPS.

The proper disposal of beet leaves is a mooted question. The fact that the beet crop removes considerable fertility from the soil is one well established. To continue the process of removing without restoring it would exhaust the land. This fact is not peculiar to the beet crop, but is true of any other. In the leaves and crowns of the beets, removed in topping, is stored considerable of the fertility taken from the soil. These tops and leaves are available for general feeding purposes, and it is customary to so use them. Often they are gathered and sold in cities and towns the same as hay or straw. Everyone is agreed as to their value for animal food. In the hands of a systematic, frugal farmer they can serve the purpose both of animal nutrition and fertility. This is accomplished by collecting the barnyard manure resulting from the feeding and spreading it on the soil. If this system is followed there can be no question about the propriety of feeding

the leaves and tops. A considerable amount of feed can be secured in this way. The combined method of feeding and fertilization is the one prevalent in Europe. Our laxity in fertilizing lands would reduce the probability of their elements of fertility ever getting back to the soil.

There are different methods of feeding these tops. The most simple method is to turn a large number of cattle in the field to consume them at once before they have had time to lose their succulency through drying; another is to allow them to cure on the ground, the same as hay, and then to store them or stack them, feeding them at will; another is to mix them in making ordinary silage, or with the pulp in the silo. I should say the choice of method depends upon the circumstances, facilities, and the plans of the farmer. Feeding them is commendable, as the manure is returned to the soil. In the beet-sugar countries of Europe beet leaves are not only used fresh but they are often kiln-dried, the same as pulp, pressed and baled, and sent out for common consumption. In this way they lose their local use for fertility but they are sure to serve this end to somebody else. The beet leaves are as carefully collected and used as is the beet pulp. The following clipping from a paper published in a beet-growing district will indicate the value put on tops, leaves, and beets as stock food:

Nebraska City (Nebr.) News, January 7, 1904: The Nebraska sugar beet promises to serve other useful purposes than that of sugar making. Among these is stock feeding; and this means more than the mere utilization of the by-products of the sugar factory; it means that both the beet tops and the root, as taken from the beet fields, will be useful as material for fattening beef, mutton, and pork.

Practical tests of the beet and the beet tops have been made in Colorado, and the results have been highly flattering. The most interesting test was made by E. H. Bushnell, a farmer living near Fort Collins, Colo. He bought 1,500 head of old ewes, which he got very cheap, the animals having outlived their usefulness upon the range. Some of these he got as low as 50 cents a head, while the balance cost him 2 cents per pound at the shipping points. Then he bought 40 head of hogs, and, having a number of milch cows on hand, he started in on his beet-feeding experiment.

In order to fully carry out the experiment he bought his neighbors' beet patches, and as soon as his sheep arrived from the ranges he began to herd them in the beet fields in order to utilize the beet tops which lay scattered over the ground just as the toppers had left them. He did not permit the animals to gorge themselves upon the tops, but allowed them to feed about an hour and a half in the morning and two hours in the afternoon.

The sheep took to their new diet with great avidity, and refused any other fodder as long as the beet tops lasted. The sheep were thus fed for a whole month, receiving no other kind of fodder whatever. Then they were put into the lamb feeding pens and placed upon an exclusive ration of sliced beets, which they appeared to relish just as well as they had the tops. The sheep were given an average of 20 pounds of beets per head per day. For a month at the latter part of the feeding season they were given an additional ration of half a pound per head per day of corn chop. Both beets and corn chop were given in two equal daily rations.

The sheep showed remarkable improvement right along. A part of them brought \$4.50 per hundredweight and the balance brought \$5.15 per hundredweight. The

weights ranged from 100 to 110 pounds per head. This year he is feeding 1,200 head of the same class of sheep upon similar rations. The only change he makes in the programme is to feed for a shorter period on tops and a longer one on beets. Next year he will plant 25 acres of sugar beets exclusively for stock feeding. He also ascertained that sugar beets were an excellent feed for dairy cows.

ALCOHOL AND VINEGAR.

The waste molasses of a sugar factory is being also used in the old countries in the manufacture of alcohol. We have at Bay City, Mich., the Michigan Chemical Company distilling alcohol from this by-product. This company started up about three years ago, and has built up a large business. It is buying the waste molasses from factories all over the country and making alcohol.

In conversation with two leading chemists during the past summer who have investigated thoroughly the alcohol production of Europe, and are giving the question considerable attention in this country, I was informed that the alcohol could be produced from beets in this country at an actual cost of 10 cents per gallon, and that alcohol could be produced from the waste molasses of a beet-sugar factory at a less figure.

A plant was installed at Caro, Mich., during the past summer for the express purpose of manufacturing vinegar from the waste molasses of a sugar factory. It is claimed in the Michigan Tradesman of July 1, 1903, that much of the vinegar now in use is made from corn which costs about \$14 per ton, while this waste sirup costs the vinegar factory about \$2 per ton, and that more vinegar can be made from a ton of molasses than from a ton of corn, and of better quality.

OTHER BY-PRODUCTS.

Considerable is being printed in the public press about discoveries of other commercial products to be obtained from the refuse of the sugar of the sugar factories. It was announced last summer in many newspapers that a discovery had been made that the pulp could be dissolved into five distinct valuable commercial commodities: Wood alcohol, pure carbon, glue, glycerin, and acetate of lime, and that a company had been organized to prosecute this work.

It is a common knowledge that we are making alcohol from the sawdust heaps of our lumber mills; we are decomposing the tissues of wood fiber and turning them into commodities of every-day use. We are using sugar beets for the adulteration of chicory, which is itself an adulterant of coffee. We have factories manufacturing milk sugar from the skim milk of the creamery, and certain other kinds of sugars are made from the waste wood fibers. It seems reasonable, therefore, that the beet fiber should yield other useful products than those which have already been made.

A gentleman of inventive turn of mind showed me the light flakes of dried pulp saturated with beef extract which he was using as an adulterant of mincemeat. He felt fairly well assured of success. Last summer the Denver press announced that a gentleman is operating in the same way with beet leaves, treated with the juice of tobacco, to produce an adulterant of cigars.

FACTORY AND FARM RESULTS IN 1903.

Under this head I shall endeavor to give as far as possible the climatic conditions prevalent during the year, the tonnage of beets worked in each State where practicable, the amount of sugar produced, and the features of improvement and general conditions prevalent in each factory district.

ARIZONA.

Official name of company: Eastern Sugar Company.

Built: 1903 (not yet completed).

Capacity: 800 tons of beets daily.

The building of this factory has already been referred to. It is so nearly completed that it is placed in the list of factories.

This factory is situated near Phoenix, at a small place called Glendale. It is of modern construction throughout, built of iron and steel. A large acreage of land is also part of the company's property. Before completion, about December 1, the factory went into the hands of a receiver. The Eastern Sugar Company had failed to market the bonds issued to secure money to complete the plant. Arrangements are proceeding, however, under the receiver, to continue the work of raising the money needed. The factory was to have begun operations about the 1st of May. It will not be able to do so under the present circumstances. The trouble arose about the time beets should have been planted to produce the crop for its spring campaign, and naturally prevented the putting out of a crop of beets. It is quite likely that this plant will begin operations in the spring of 1905.

COLORADO.

The past season's work again demonstrated Colorado's adaptability to sugar production. Eight factories were in operation. These worked 447,865 tons of beets and produced 50,853.5 tons of sugar, for which the consumer will pay 5 cents a pound, or \$5,085,350.

Five years ago Colorado was importing every pound of sugar consumed. At that time the consumption of sugar in the State was estimated to be about 18,457.7 tons. At present it is producing sugar enough to meet this consumption and in addition 34,795.8 tons.

The farmers received in the State during the past year \$2,071,376 for beets produced. For fuel, labor, transportation, supplies, etc., the eight companies distributed about \$2,000,000 more.

Cities and towns were materially improved in general appearance, the volume of business was greatly enhanced, and the population materially increased. In the State about 50,000 acres tributary to the factories were employed in growing the beets. As results of the rapid development of this industry, land values have greatly increased, railroads and electric lines have been built, live stock interests have rapidly grown. On the whole the season was quite favorable. The tonnage was large, and the sugar content and purity of the beets were high. As a rule this crop highly rewards the farmer for his services. It is easier to secure sufficient acreage in this State than in any other. Probably in no other State has this industry redounded to the farmers' benefit so much.

FORT COLLINS.

Official name of company: Fort Collins, Colorado, Sugar Manufacturing Company.
Built: 1903.

Capacity: 1,200 tons of beets daily.

The area planted is estimated at 7,399 acres. The factory at this place is one of the new ones, commencing operations the past season. The factory itself is well built and well equipped. It was late in completion, which accounts for the lateness in beginning its campaign. The season was quite favorable, and the crop was exceedingly good, considering that it was the first campaign.

At this place is located the State agricultural college and experiment station. The experiment station has conducted exhaustive experiments in beet growing and feeding pulp.

On account of lateness in commencing operations, a considerable portion of the first beets harvested was sent to the factories at Greeley and Loveland on an arrangement made with the managements of these two concerns. In its own bins and stacked up around its various shipping points throughout the country were collected about 40,000 tons of beets before the factory began operations.

To facilitate the shipment of beets, ten dumps were built along side-tracks in various parts of the beet-sugar territory tributary to this factory.

EATON.

Official name of company: Eaton Sugar Company.

Built: 1902.

Capacity: 600 tons of beets daily.

The population of the town is about 1,000. The agricultural area tributary to it is about 100 square miles. One hundred and fifty miles

of irrigation canals are fed from the Cache La Poudre and the Larimer rivers. The main crops in order of importance are grain, alfalfa, potatoes, and sugar beets. Governor Eaton has 15,000 acres of land here, 12,000 of which are under cultivation. His sons have 6,000 acres. From tenants the following rentals are received: One-third of the grain and potatoes, one-fourth of the sugar beets, and one-half of the alfalfa, the renter furnishing everything. The Eaton district produced last season 15,000 bushels of wheat, 1,500 cars (or 22,500 tons) of potatoes worth \$210 a car, or \$315,000. It is estimated that the factory sliced 55,000 tons of beets, paying the farmers therefor, at the rate of \$4.50 per ton, \$247,500. The estimated acreage of beets was 6,000 acres. About 65 per cent of the beets came by railroad and the rest were delivered direct from the farms. The estimated cost of beet production was \$35 per acre. The pay of employees of the factory during the campaign from October 1 to January 10 amounted to \$50,000; during the rest of the year, \$25,000.

In addition to the beets grown locally, a large acreage was planted at Fort Morgan and Sterling, Colo. It may be assumed that, with two favorable years behind it and with the experience acquired, this factory is fairly started on a successful career.

The season was favorable for beet production in the vicinity of Eaton. The beets were of excellent quality and returned a good tonnage per acre. This particular section of the State has been famous for its heavy production and fine quality of potatoes, which have been the principal product.

GRAND JUNCTION.

Official name of company: The Western Sugar and Land Company.

Built: 1899.

Capacity: 350 tons of beets daily.

Contracts have been made with the farmers and every arrangement perfected for putting this factory in operation in 1904. It has been idle for the past two seasons. The company itself will control about 4,000 acres of its own. Since scarcity of beets has been its principal obstacle, this amount of land under control of the factory will overcome the difficulty. Several places along the railroad tributary to this place will contribute beets. Unfortunately the experience of this factory has been the only thing to mar the universal success of the beet-sugar industry in Colorado. It is now believed that this factory will eventually be a success. The factory is a first-class brick and steel structure, equipped with modern machinery. It will be thoroughly overhauled.

GREELEY.

Official name of company: Greeley Sugar Company.

Built: 1902.

Capacity: 800 tons of beets daily.

It is generally believed that the conditions around Greeley are as nearly ideal for the beet-sugar industry as in any place in the United States. The season was good throughout the year and results were everything that could be desired, considering the short period of experience the farmers have had in growing beets. Delivery of beets began October 1. The factory began operations October 10 and closed January 17. The average purity and sugar content during the campaign was very high. A late freeze did some damage to early beets. On the whole, it has been a remarkably successful year for all interested.

From the Denver News the facts as to production in the Greeley district have been condensed. Greeley is one of the pioneer agricultural districts. Lands cultivated the longest are the most productive. Its line of crops run in order of importance as follows: alfalfa, potatoes, wheat, sugar beets, oats, and barley. Some land has been in cultivation since 1870. Formerly the yield of wheat ranged from 25 to 30 bushels per acre, but it ranges now from 30 to 60. Potatoes ranged in yield formerly from 70 to 80 sacks (of 100 pounds) to the acre; this year the yield was 100 sacks. The estimated cost per acre of raising wheat is \$10; the average yield 40 bushels per acre; the present price 90 cents per bushel, or \$36 per acre. The cost of raising potatoes is from \$30 to \$35 per acre; the yield of 100 sacks at the present price of 70 cents per sack gives a net profit of \$35 per acre. It is estimated that the factory sliced this year 55,000 tons of beets, paying the farmer \$247,000, and making therefrom 12,000,000 pounds of sugar. An acreage of 4,800 acres of beets was contracted for the past season to be grown along the Union Pacific lines to Denver and Julesburg. The farthest distance at which beets were produced from the factory was 40 miles. About three-fifths of the beets were brought in over the Union Pacific and two-fifths were delivered by wagon. There were 550 individual growers. One man with 22 acres of land harvested 26 tons per acre; others grew as high as 30 tons per acre. The estimated cost was \$30 to \$40 per acre. The average tonnage of beets was 11.5; the price \$4.50. The gross average receipts per acre were \$51.75; the net average receipts per acre \$16.75. Considering that these were averages, the results were good. In 1903, during the campaign from October 10 to January 17, the pay of employees amounted to \$70,000; during the remainder of the fiscal year, \$19,000. The beet pulp produced amounted to 20,000 tons, 90 per cent of which was used within 2 miles of the factory. The price was 35 cents, f. o. b., or in the silo, for local growers, and 50 cents at the silo for nongrowers. The factory is feeding 5,000 head of Mexican and southern sheep. Sheep are marketed at Missouri River points and Chicago. Five hundred head of cattle are to be fed.

LOVELAND.

Official name of company: Great Western Sugar Company.

Built: 1901.

Capacity: 1,200 tons of beets daily.

The past year was the third in the experience of the factory at this place. It shared with the other factories in this portion of the State in the large yield of beets due to a favorable season. This factory probably has more outside equipments than any other in the United States. It has built and owns a railroad called the Great Western and Denver, which is about 18 miles in length. This road was constructed especially to facilitate the delivery of beets to the factory, and is operated in connection with the Colorado and Southern. The factory is equipped with automatic wagon and car dumps. It has about 50 cars of its own, built especially for hauling and dumping sugar beets. In addition, during the beet-delivery season, it has under its special direction nearly twice this number of cars furnished by the Colorado and Southern Railroad. The beets are delivered to the factory in car lots, which are automatically dumped into the bins. All along the routes of these two railroads, in the beet-growing territory, automatic wagon dumps are arranged for loading the cars.

This part of the State has been specially devoted to sheep raising. Yards are fitted up near the factory where a large number are fed the pulp. Beet deliveries began September 23. The factory opened October 1 and closed January 23. The price of beets was \$4.50. The factory employed about 400 men and boys, the monthly pay roll for which was about \$25,000. Its skilled employees and office force number 35, and the amount paid to employees was about \$132,000 for the season. Wages in the field are \$1.50 to \$2.50 per day. The cost of bunching, thinning, hoeing, pulling, and topping is \$20 per acre. The acreage planted was 8,959 acres. The factories brought into the district about 1,500 laborers. The acreage harvested was 8,700 acres. The number of growers was 600, and the tracts ranged in size from 5 to 240 acres with an average area of about 15 acres.

LONGMONT.

Official name of the company: Longmont Sugar Company.

Built: 1903.

Capacity: 600 tons of beets daily.

The farming area tributary to this place enjoyed an exceptionally favorable season during the past year. This is the first campaign of the factory established at this place. Beets did remarkably well considering that this was a trial crop. Japanese, Mexican, and Russian laborers flocked to the place and engaged in the farm work in the beet fields. The factory was quite late in completion, and consequently late in beginning its campaign, which opened December 18, and closed

February 14. With the plant was installed a department for working the molasses for a further extraction of sugar by the Steffens process. About 1,000 acres of its beets were grown at Brush and Fort Morgan, Colo.

ROCKY FORD.

Official name of company: American Beet Sugar Company.

Built: 1899.

Capacity: 1,000 tons of beets daily.

In the beet area tributary to this factory the season was hardly up to the average. An early frost did some damage, and the beets were more or less injured by insects. This applies especially to the beets grown for this factory in the eastern part of Colorado and the western part of Kansas, where beets were damaged materially. One feature in this unfavorable season demonstrates the hardiness of sugar beets: Toward the middle of September the temperature dropped very low, resulting in heavy frosts and considerable freezing, which was quite destructive to cantaloupes and resulted in heavy loss, as they are grown extensively in this district. Fruits and other crops were injured materially. The damage to sugar beets was imperceptible. Spring frosts, insect pests, and drought materially affected all crops, including the beets.

While visiting the beet fields in Colorado I was told by many farmers that the freedom of the beet crop from dangers due to freezes and hail-storms was one of the leading arguments in its favor. This company has made many important changes and improvements during the past season. Among others is the introduction of the Steffens process for extracting the sugar from the molasses. The beets, as usual, averaged very high in purity and sugar content. For beets testing 15 per cent sugar and 78 per cent purity \$4 per ton was paid. For each per cent of sugar above this standard $33\frac{1}{2}$ cents per ton is added. The factory opened October 5 and ran sixty-two days.

SUGAR CITY.

Official name of company: National Sugar Manufacturing Company.

Built: 1899.

Capacity: 500 tons of beets daily.

The early spring started up with plenty of water in the ditches. This company has a storage lake on its own lands which is usually abundantly stored with water. The season was favorable for preparing the land and for planting and germination. Considerable damage occurred to the early planting from late frosts which prevailed in that part of the State; several hundred acres had to be replanted. This company has about 12,000 acres of land of its own, a large part of which is under cultivation. It was originally started in a new and unsettled district, and was dependent largely upon its own resources for beets

from the beginning. During the past season about 2,000 acres of beets were grown by private individuals in addition to those planted upon the ranch. The latter part of the season was not so favorable, the results of the beet crop being hardly up to the average of tonnage. The average of sugar content and purity was very high. The company made quite a number of internal and external improvements, among other things constructing beet dumps at various places in the beet-growing areas to facilitate shipment of beets. The factory began its campaign October 8 and closed December 25. The area planted in beets was estimated at about 5,000 acres. The period of operation was only seventy-two days, being shorter than in previous years. The slicing of beets closed December 17.

WINDSOR.

Official name of company: Windsor Sugar Company.

Built: 1903.

Capacity: 600 tons of beets daily.

This factory opened this year for the first time. Contrary to the rule of new factories, it was completed in time to admit of an early campaign. The season was fairly good.

For 1904, the factory pays \$5 a ton for beets, one-third to be delivered in November, and one-third in December, and 20 cents extra for beets that have to be siloed. The farm owner receives one-fourth of the crop for rent. This company has in view the building of a steam railroad about 18 miles long tapping additional beet-growing area; the factory opened November 5, and closed its campaign January 20. The beets were all grown near enough to the factory to be delivered by wagons. The largest grower had 200 acres which averaged 18 tons per acre. Five thousand head of cattle are fed pulp near the factory.

CALIFORNIA.

California has 8 factories, only 7 being in operation. The past season 543,601 tons of beets were sliced, and 66,656.9 tons of sugar produced. The farmers received for these beets about \$2,564,166, and about \$2,000,000 were paid for fuel, labor, transportation, and supplies. While the factories have not increased in number in the State, those in operation have materially increased their capacity and output and improved their facilities.

These 8 factories are large and have a combined producing capacity equal to that of 20 ordinary factories. Being large, they have experienced considerable trouble in securing sufficient supplies of beets. This condition brought about developments in the State that probably would not have occurred so soon. A few years ago the beets in California were grown entirely without irrigation. The water saturation of the soil, due to winter rains, which produced subirrigation, along

with occasional spring rains, was depended upon for producing a crop of beets. This was found insufficient. Irrigation by the use of water from streams, etc., was rapidly extended, and in addition, artesian wells were sunk. There has been a very rapid development of the sources of water supply. New districts were studied and opened up for beet production; roads were built and barges were used. Now the factories of this State are receiving a sufficient and stable supply of beets. These companies probably overstepped the line of wise economy in the size of the factories built and in making enlargements. It has taken several years for them to work up a corresponding supply of beets.

In maintaining the beet-sugar industry this State is favored in many respects. It has large fruit-producing interests, which create a demand for sugar in preserving these fruits in different ways for the market. Its location on the Pacific Ocean, permitting of water shipment to the eastern markets of our country, will be especially favorable when the Isthmian Canal shall be built.

CROCKETT.

Official name of company: California and Hawaiian Refining Company.

Built: 1898.

Capacity: 1,200 tons of beets daily.

No report of operations at this point has been received.

CHINO.

Official name of company: American Beet Sugar Company.

Built: 1891.

Capacity: 1,000 tons of beets daily.

The season in the beet-growing area tributary to Chino was quite favorable during the past year. Rains were abundant, and the crops received sufficient moisture throughout the growing period. The factory was delayed in starting its campaign on account of the lateness of the beets in ripening. The steam plow for stirring the land was a new feature introduced in beet growing the past season. The crop gave fair returns; the sugar content and purity of the beets were unusually high. The factory began operations August 8 and closed October 30, being in operation eighty-two days.

LOS ALAMITOS.

Official name of company: Los Alamitos Sugar Company.

Built: 1897.

Capacity: 700 tons of beets daily.

The past season was a record breaker for this factory. It sliced a considerably larger tonnage than in any previous season. With slight exceptions the weather was generally favorable to beet growing. About the middle of April a very heavy rain occurred, flooding some of the lowlands where beets were grown, which necessitated replant-

ing in many instances. The continuous heavy fog, very much prized by farmers of this district on account of its general benefits, prevented the drying out of this flooded district. Caterpillars and cut-worms attacked the crop and did considerable damage on these wet lands.

The factory received a general overhauling and repairs and many new improvements were introduced. Electric power was installed in many parts of the factory, very much facilitating its operation. Artesian wells for irrigation are increasing very rapidly. The area of ground upon which beets are grown by irrigation is rapidly increasing. At the present rate of increase in two or three years it will be possible to produce by irrigation all the beets needed by this factory. When it was built nothing of this kind existed. Ordinarily irrigation is not required here. One or two seasons of drought demonstrated the necessity of some provision for irrigation as a matter of security in dry years. Large feeding yards are in close proximity to the factory and the pulp produced by it is consumed by the stock. The factory not only received the highest tonnage of any previous year, but the beets have averaged much higher in sugar content. This district has always produced beets of high quality. The factory began about July 20 and worked several days on brown sugars. Beet deliveries began July 23. The factory began slicing July 25 and closed November 12.

OXNARD.

Official name of company: American Beet Sugar Company.

Built: 1899.

Capacity: 2,000 tons of beets daily.

This is a mammoth sugar-producing plant. It has accomplished wonders in Ventura County. It can handle in a campaign, if necessary, 200,000 tons of beets. This is not only due to its large capacity, but to the length of season for maturing beets in its tributary district. Planting is begun in November and December and continues in different valleys until May. The demands for labor and the general improvement of railroads and other facilities have been something wonderful. The town of Oxnard, containing several thousand inhabitants, was built up entirely under the influence of this sugar plant. Notwithstanding its size, it is not even an incorporated town. The season has been unusually favorable, resulting in a good tonnage per acre and a high sugar content and purity.

From its beginning this plant has been a leader in all the best and newest methods and devices for promoting the best interests of the sugar industry. It has promoted extensive cattle feeding, has constructed large facilities for this purpose, and thousands of head of cattle are fed from pulp produced by the factory. At the beginning of the season, certain labor troubles had a tendency to interfere with

the work of growing the beets. These were soon amicably adjusted without any material interference with the crop.

More or less trouble was experienced with worms, but there were no serious consequences. Under the factory management, and in connection with the United States Government, some valuable soil experiments were conducted. The factory controls about 12,000 acres of land of its own which guarantees its supply of beets. Some of the land near the ocean on this ranch is quite strongly impregnated with alkali. The purpose of these experiments was to remove the alkali by leaching the soil through irrigation. These lands were tiled; the surplus water was drawn off into ditches connected with the ocean, carrying with it portions of the alkali. The soil was analyzed from time to time to ascertain the amount leached from the lands. Under this system it was estimated that many tons had been removed from the soil. The factory commenced work June 27, worked two weeks on molasses with the osmose process and closed its regular campaign October 16.

SPRECKELS.

Official name of company: Spreckels Sugar Company.

Built: 1899.

Capacity: 3,000 tons of beets daily.

The season has been quite favorable to beet growing in the area tributary to this plant. The amount of beets worked by this factory was very much reduced, however, from that of former years. A difficulty arose between the management of the factory and the beet growers as to the price to be paid for beets. The factory offered \$4.50 and the farmers demanded \$5 per ton. This price was declined, and many of the former growers refused to produce sugar beets. The plant has a large acreage of its own, and it produced on its lands near the factory about 58,000 tons of beets. It is said that the average yield of these lands was 14.4 tons per acre. On another ranch it produced a large acreage that is said to have yielded 15 tons per acre. This is a very high tonnage, and indicates a net profit per acre above expenses of \$24.80 in the first instance and \$27.72 in the second.

The supply of beets for the season was about one-third what it should have been. The factory started September 9, ended beet slicing November 28, and was in operation about eighty-six days.

ALVARADO.

Official name of company: Alameda Sugar Company.

Built: 1879.

Capacity: 800 tons of beets daily.

The past season was fair and the crop was good. The price of beets has been raised from \$4.75 to \$5 per ton. The beets produced were of excellent quality. The factory began September 14 and finished its

campaign December 21, having one of the most successful seasons in its history.

BETTERAVIA.

Official name of company: Union Sugar Company.

Built: 1898.

Capacity: 500 tons of beets daily.

The season was quite favorable, the tonnage of beets was larger than usual, and the quality was above the average. This factory offered a prize to the growers for the highest tonnage on a given acreage. The farmers appear to be well satisfied, and the company has experienced no difficulty in securing a sufficient supply of beets. The factory began operation about the middle of July and closed about the middle of December. It anticipated a campaign of about one hundred days, but really operated for one hundred and forty-nine days.

The company is putting in a large pumping plant having a 150-horse-power Corliss engine, with a pumping capacity of 4,500 gallons per minute, to furnish sufficient water for irrigating 15,000 acres during the season. This company is perfecting its facilities for absolutely insuring a sufficient supply of beets.

IDAHO.

IDAHO FALLS.

Official name of company: Utah Sugar Company.

Built: 1903.

Capacity: 1,600 tons of beets daily.

The factory was in operation in this place during the past year for the first time, which is the beginning of the beet-sugar industry in the State. The season has been excellent and the results in beet growing have exceeded expectations. Some farmers produced as high as 25 tons per acre and the beets were of good quality and purity.

The opening of this factory was celebrated with considerable ceremony at the laying of the corner stone April 14. The citizens of Idaho Falls, Iona, and other parts of the State observed the occasion as a holiday, the farmers for miles around being in attendance. The factory was under contract for completion by October 1. It was important to start early from the fact that the 1-cent bounty offered by the State expired on December 31. After that the bounty dropped to one-half cent per pound. It was nearly the middle of November, however, before the factory could begin operations. Consequently a considerable portion of the sugar manufactured received the reduced bounty. Everything considered, the results were magnificent for a new district. They augur favorably for other plants contemplated along the Snake River Valley and at other places in Idaho. This company grew on its own lands one-fourth the beets worked by the factory.

The farmers are taking hold of the new enterprise and many new contracts will be made next year. In addition to these the factory will bring into service more of its own lands, and it is anticipated that it will have a complete supply next season. The unique thing about this factory district is its system of irrigation. Usually this is accomplished by lateral ditches leading out and flooding the land or saturating it by means of close parallel irrigation furrows. Irrigation is accomplished in this district by saturating a large body at a time by a method of subirrigation. The main ditch is conveyed along the highest elevation of land to be irrigated. Here the water is confined and allowed to sink in the ground. Several feet underneath the surface there appears to be a stratum of hardpan impenetrable by the water. This saturation is continued from the main ditch until the entire body of soil above the hardpan is thoroughly moistened. At the lower elevation of the piece of land another ditch is made, which catches the surplus water and conveys it to other fields requiring irrigation.

MICHIGAN.

The beet-sugar industry in Michigan experienced an unfavorable season during the past year, as in the two preceding years. There was considerably more rain than was desirable, necessitating expensive work in weeding and cultivation. The cold, wet rains of the fall delayed the harvesting and belated the work of the sugar factories. The tonnage of beets throughout the State was low in comparison with past experience. The results were not at all favorable in comparison to what was naturally anticipated. In the State there was produced during the past year 561,239 tons of beets, from which 62,425 tons of sugar was made, worth at retail \$6,242,500. For the beets grown the farmers of the State were paid \$3,000,000. For labor, fuel, transportation, supplies, etc., the factories paid also to local sources at least \$2,000,000. It may be stated that the sugar industry in this State is yet in its trial stage. Factories have been erected too rapidly in the southern portion for the best results. Under the most favorable natural conditions a new factory is hampered at the start. This is largely due to the lack of experience on the part of everybody connected with it and inability to secure a sufficient supply of beets. Its first prime necessity is beets. Any factory with ordinary advantages having a sufficient supply of beets of the kind produced in Michigan is bound to make a success in this country. The sugar industry finds many extraordinary advantages in the State of Michigan, but it must have the beets; it is as useless without this supply as a watch without a mainspring. The farmer will not produce the beets unless he can procure sufficient tonnage per acre at an ordinary price or receive a sufficient price for a low tonnage to justify beet raising. To new beet

growers the results in Michigan the past year were not encouraging. The average tonnage was low; the price of beets was too high for the kind and quality. The results of the year were discouraging. Most of the factories in the State secured less than 50 per cent of a full supply of beets; none of them exceeded 75 per cent of the supply needed for a complete campaign.

In the lower part of the State there are so many factories that they are in each other's way, as it were, each competing with the other for the acreage available for beet growing. Though every year sees many additional farmers permanently launched in sugar-beet production, the establishment of factories has outstripped this growing supply of beets. Southern Michigan needs a rest in factory building in order to adjust the situation. Everything indicates that the beet production of Michigan will rapidly overtake the demand of the factories if it is given time to develop. The State has available territory, markets, and advantages which will eventually justify a large increase of its sugar interests.

Michigan farmers can not grow as high a tonnage as they do in the Western States under irrigation; their beets are not naturally of as high a quality and probably they never will be; but they can grow beets and double the tonnage now produced in the State, the beets being of better quality and grown at one-fourth less cost than those produced by irrigation. What is needed is better farming, better cultivation, and fertilization. The successful sugar-beet farmers are rapidly developing in Michigan. I contend that, all things considered, Michigan will be as successful in this industry when her resources are fully developed as any State in the Union. Michigan is a populous State, and her consumption of sugar is large. Last year the product of sugar was three-fourths of the amount consumed in the State. The factories already established are capable of producing more than the amount of sugar consumed in the State.

ALMA.

Official name of company: Alma Sugar Company.

Built: 1900.

Capacity: 750 tons of beets daily.

This plant had a comparatively large supply of beets. It has undergone extensive repairs and improvements. Weighing stations were established in towns throughout its beet-growing area, thus facilitating the delivery of beets. In addition to the regular work of the factory the company has installed a plant for drying the pulp after mixing it with molasses. This product is becoming a popular stock food and is shipped to all parts of the country. The beets average somewhere between 14 and 15 per cent sugar.

This company issued directions to the farmers for siloing the beets.

It has an arrangement with the farmers to pay 25 cents per ton extra for all beets siloed to await delivery to the factory after the bins have become filled. The factory started October 19 and closed December 13.

BAY CITY (2 FACTORIES).

Official name of company: Michigan Sugar Company.

Built: 1898.

Capacity: 500 tons of beets daily.

Official name of company: Bay City Sugar Company.

Built: 1899.

Capacity: 750 tons of beets daily.

There have been two factories operating at this place, one owned by the Michigan Sugar Company and the other by the Bay City Sugar Company. In the early summer (1903) the two concerns were united under one management, taking the name of the Bay City Sugar Company. The season was unfavorable, the yield of beets not very satisfactory, and the harvested area was small. Both factories have been overhauled and given extensive repairs, and the first of the two factories installed a plant with a capacity of 900 tons of pulp daily for manufacturing and preparing dried pulp. This is the second factory in the State operating a plant for drying the pulp. This factory will dry the pulp produced by both sugar factories. The Michigan Sugar Company plant closed December 10, and the remainder of its stock of beets was worked by the plant of the Bay City Sugar Company. The latter began operations October 27 and closed December 28, having a campaign of sixty-two days. Michigan Sugar Company began November 2 and ran for twenty days.

WEST BAY CITY.

Official name of company; West Bay City Sugar Company.

Built; 1899.

Capacity; 600 tons of beets daily.

This factory had a considerably larger stock of beets than usual. The farmers received a fair tonnage per acre. The beets were of fair quality and purity.

SALZBURG.

Official name of company: German-American Beet Sugar Company.

Built: 1901.

Capacity: 400 tons of beets daily.

This factory received more than the usual supply of beets. Like the other factories in this district, its beets were grown under quite unfavorable weather conditions. Farmers produced a fair tonnage, and the beets were of good quality. The factory began October 22 and closed about December 27.

CARO.

Official name of company: Peninsular Sugar Refining Company.

Built: 1899.

Capacity: 600 tons of beets daily.

The beet season in the farming district around Caro was fairly good. The stock of beets procured by the factory was larger and better than usual. Indications are that the planting will be considerably increased next season. The factory started October 22, closed slicing December 17, and shut down December 23. The run covered a period of sixty-one days.

CHARLEVOIX.

Official name of company: Charlevoix Sugar Company.

Built: 1903.

Capacity: 600 tons of beets daily.

The factory at this place had been building for two years. During the past season the farming district tributary to it grew about 3,000 acres of beets, and the company itself grew a large acreage. The season was unfavorable; tonnage of beets was not satisfactory, but the quality was good. Many of the beets froze in the ground. For some reason the company decided not to operate this year and the beets were shipped to other factories.

A special correspondent of the Beet Sugar Gazette, writing under date of December 12, 1903, says:

The Charlevoix Sugar Company has decided not to slice beets this year. The factory is practically finished and they could have begun to run on water two weeks ago, but the unusually early severe weather caught quite a percentage of the company's beets and likewise the farmers' beets. Besides, the stringency of the money market prevented the company from getting its required amount of working capital, which was promised and arranged for. No blame is attached to the National Construction Company, as the factory could and would have run had the foregoing conditions been met.

It is now the intention of the company to complete the equipment of the factory at 600 tons, raise about 6,000 acres of beets, and begin slicing October 1, 1904. The average sugar content of all the Charlevoix beets last year was 15.1 per cent, and this year above 15.25. This is remarkable.

CARROLLTON.

Official name of company: Valley Sugar Company.

Built: 1902.

Capacity: 800 tons of beets daily.

The factory opened October 28, and closed January 2, having a campaign of sixty-seven days. The season was unfavorable and the tonnage low. The quality of the beets was good.

CROSWELL.

Official name of company: Sanilac Sugar Refining Company.

Built: 1902.

Capacity: 600 tons of beets daily.

The season was quite unfavorable and the crop returns unsatisfactory.

The area of beets harvested was 5,500 acres. The factory started about October 15, and closed December 31. The sugar content and purity of the beets was unusually high.

EAST TAWAS.

Official name of company: Tawas Sugar Company.

Built: 1903.

Capacity: 600 tons of beets daily.

The molasses from this factory was disposed of to be used in the manufacture of alcohol.

This factory operated for the first time this year. The weather was unfavorable and the tonnage of beets produced quite unsatisfactory. Its supply of beets was very light compared with a full supply. It closed down for a short time.

HOLLAND.

Official name of company: Holland Sugar Company.

Built: 1899.

Capacity: 250 tons of beets daily.

The farming district tributary to this factory shared in the generally favorable conditions affecting the other factories of Michigan. It was late in starting on account of the cold, wet weather. It began October 19 and finished slicing December 31. This company tried a new method of eliminating the impurities of the beet juice. It introduced a system of omosing the juice before evaporation. This would probably entail considerable expense on account of the volume of the juice, but it would undoubtedly lessen the expense and increase the extraction when the juice is evaporated.

KALAMAZOO.

Official name of company: Kalamazoo Sugar Company.

Built: 1899.

Capacity: 500 tons of beets daily.

The beet area tributary to this factory experienced a fair season during the past year. Its planted area was small, but the farmers growing beets for the factory were well rewarded for their efforts. The factory is located in a district having superb natural conditions. Land values are high in the vicinity of the factory. The place is famous for celery production. Some of the lands upon which celery is grown are valued as high as \$400 per acre. It has a large farming district well adapted to the beet-sugar industry. The factory management is competent, and it is officered by some of the best business men in Michigan. The factory is well built and well equipped. With all these things in its favor, the enterprise has been unsatisfactory. It is one of the best illustrations of the need of the farmers' cooperation

for success in the beet-sugar industry. This industry is especially adapted to this place, and the farming conditions are especially adapted to it; yet the farmers are not growing the beets. There is no question that it presents a better opportunity to them than any other crop, except, possibly, celery. Celery requires peculiar conditions, and the district is limited in land available for this purpose. There is plenty of land for both. No doubt even celery growers will find, in time, when all the advantages of a factory are felt, that beet growing will compare favorably with celery. It is evident that this sentiment does not prevail at the present time. Inquiring into the reasons for this condition, I was convinced that it was due to a subtle local sentiment on the part of the farmers, based on an entire misunderstanding of the situation, and the cause of this sentiment was difficult to locate. The factory, however, is gradually overcoming the local sentiment. Beets the present year were grown in places tributary to the factory in Michigan, Indiana, and Ohio. It has a larger supply of beets this year than any previous year. This success this year is likely to result in a better supply next year. Once a full supply is secured, there is reason to believe that it will be permanent. When its usefulness is once fully felt and appreciated, this factory will be one of the most successful in the State.

MARINE CITY.

Official name of company: Marine Sugar Company.

Built: 1899.

Capacity: 350 tons of beets daily.

This factory was not successful in securing a sufficient acreage. The district started with a fair season, but there were excessive rains during the growing period, especially toward the close. A fairly good yield was received, but the total supply of beets was inadequate. The campaign was shortened to about one-third. The factory began slicing beets October 19 and closed December 2. The beets averaged 14.2 per cent of sugar.

MENOMINEE.

Official name of company: Menominee River Sugar Company.

Built: 1903.

Capacity: 1,000 tons of beets daily.

A factory was operated at this place the past season for the first time. It is one of large capacity. Its planted area was limited and its supply of beets gave it a working period of one-half a full campaign. The crop was good for the first year. It was especially high in the quality of the beets grown, probably higher than at any other place in Michigan or east of Colorado. This tends to verify the experiments made at the State experiment station of Michigan, showing that the sugar content and purity of the beet gradually increase

from the south to the north limits of the State. This factory is at the southern point of the upper peninsula of Michigan. It is the pioneer factory of this region.

The successful career of the Menominee factory during the past season, with the yield secured by the farmers, and the high price per ton due to the high content of sugar, offer good encouragement for the future. It will probably receive a full supply next year, as farmers are readily offering to contract. It is so situated that a large part of its beets are delivered by barges, towed from the farming district over the lake and its arms, to the factory. It is near the eastern border of Wisconsin, and most of its supply of beets comes from that State. It began slicing November 18, finished slicing December 19, and closed December 29.

MOUNT CLEMENTS.

Official name of company: The Macomb Sugar Company (Limited).

Built: 1902.

Capacity: 600 tons of beets daily.

The factory's acreage during the past season was limited. Its season was quite unfavorable; but on the acreage harvested, the yield was fair and the quality better than usual. It started near the 1st of November and closed somewhere near the 1st of December.

OWOSSO.

Official name of company: Owosso Sugar Company.

Built: 1903.

Capacity: 1,000 tons of beets daily.

The factory operated for the first time at this place during the past season. The unique feature of this enterprise is the purchase of a large tract of Michigan land, from 8,000 to 10,000 acres, which it purposes draining with a view to growing sugar beets. The season was exceedingly wet, and many of the beets grown for this factory were on low lands and suffered materially.

The company grew a large acreage on its own land, which it previously protected from overflow from the river by the construction of dikes. Excessive rains produced such floods that the dikes were broken through, and several hundred acres of beets inundated, most of which were damaged materially or destroyed. The company is now constructing a ditch 7 miles long, 60 feet wide at the top and 40 at the bottom, and 14 feet deep. It proposes changing the channel of the Mishtegayoc River. The dirt from this canal is thrown upon the banks of both sides, thus raising them for the better control of the current in the channel. Lateral canals are dug and it is hoped to thoroughly drain the whole tract, making it available for the production of sugar beets.

ROCHESTER.

Official name of the company: Detroit Sugar Company.

Built: 1899.

Capacity: 500 tons of beets daily.

It is said that this company secured a larger acreage than in former years. The season started out with unfavorable weather, followed by good weather and a fairly good stand. Considerable replanting was necessitated. As in most of the factory districts in Michigan, it was delayed in starting on account of the cold rains. Its stock was as large or larger than in preceding years. The beets were of good tonnage, sugar content, and purity. The factory started about October 8 and closed December 13.

SEBEWAING.

Official name of company: Sebewaing Sugar Company.

Built: 1902.

Capacity: 600 tons of beets daily.

The season here was more favorable than usual, and a good stand of beets was secured, yielding a good tonnage per acre and a fair quality of beets.

SAGINAW.

Official name of company: Saginaw Sugar Company.

Built: 1901.

Capacity: 600 tons of beets daily.

The season was bad and the acreage of beets light. The campaign of the factory covered about 60 to 75 per cent of a full campaign. Most of the farmers received a fairly good tonnage and the beets were of good quality. Much of the acreage was on low ground and suffered from excessive rains during the late summer and fall. This factory experienced the general difficulty existing in the State during the past year, namely, the scarcity and high price of labor. The factory began operations about October 23 and after a campaign of sixty days closed December 21.

ST. LOUIS.

Official name of company: St. Louis Sugar Company.

Built: 1903.

Capacity: 600 tons of beets daily.

A plant was operated at this place for the first time this year. It began operation November 25 and closed January 25. It sliced frozen beets nearly from the beginning.

LANSING.

Official name of company: Lansing Sugar Company.

Built: 1901.

Capacity: 600 tons of beets daily.

This factory shared the general bad crop season prevailing in Michigan during the past year. The yield was irregular; some farmers secured good tonnage and some very poor. The quality of the beets was generally good. The factory can hardly be considered to have had over one-half an average campaign.

MINNESOTA.

ST. LOUIS PARK, MINNEAPOLIS.

Official name of company: Minnesota Sugar Company.

Built: 1898.

Capacity: 250 tons of beets daily.

The season was rather wet in the district tributary to this factory. The early rains washed out many of the beets, necessitating replanting. This continued as late as the 1st of July. These late beets matured a fair tonnage and the sugar content of the beets was good.

The experience of this company is a good illustration of increased tonnage and improved beets by gradual development. It is apparent to anyone acquainted with the situation in this district that the farmers are producing a higher tonnage and better beets, and at much less cost, than formerly. This is due to the gradual sifting out of the poorer class of farmers and the constant increase in the number of the better class year after year.

Much of these results is due to the improved condition of the lands and the selection of a better variety of lands for beet growing than formerly. For the first two or three campaigns the factory management had to practically accept anything offered in the way of contracts with farmers growing beets, whether near or far. At the present time it is enabled to make its own selection of lands and those in the best condition and worked by the best farmers. The success of the factory seems assured. The situation has changed, so that the factory no longer energetically hunts the farmer, but the farmer industriously importunes the factory for contracts.

NEBRASKA.

Nebraska has three factories located at Grand Island, Norfolk, and Leavitt (near Ames). It was the second State in the Union to begin producing sugar from beets. These three factories are in districts where crops are grown under rain conditions. The ones at Grand Island and Leavitt are located in the Platte Valley. The Norfolk factory is in the northeast part of the State, and most of the beets are grown on farms in the valley of the Elkhorn River.

The soil supplying the crops in the vicinity of Grand Island is a light, sandy loam, characteristic of most of the soils along the Platte River. This district has a slight tendency to be too dry, yet, except in

drought years a fair crop of beets is generally produced. Beets can probably be produced in this district cheaper than in either of the other two on account of the easier working of the soil. Most of the soils upon which beets are grown at Leavitt are the dark loam known as bottom land. Considerable trouble has been experienced on account of an excess of moisture, flooding the beets, retarding cultivation and sometimes the harvesting, and lowering the sugar content and purity of the beets. The soils around the factory at Norfolk may be considered a medium between the two extremes of those at Leavitt and Grand Island. They contain more sand than those at Leavitt and more clay, and are heavier than those at Grand Island; and as a rule they are higher, better drained, easier worked, and give better results with beets, year after year, than those at Leavitt.

The feature of special interest in the State at present is the marked tendency to beet growing and factory building in the western part of the State. When the present factories were established in Nebraska, that part of the State west of Kearney was considered too dry for general cropping. During the last few years large ditches have been constructed tapping the water supply of the Platte and Republican rivers and irrigating a large farming area. These lands were immediately tested for beet production. Beets showed a good tonnage and a very high quality. All three of the present factories began to encourage beet growing in this irrigated district; they made contracts with the farmers; and last year the factories at Grand Island and Leavitt each received most of its beets from these irrigated lands. At the same time the crop proved so profitable, as compared with other things, that there will be a large increased planting in this western portion of the State next year for the factories at Grand Island and Leavitt; and it is quite probable that from one to three factories will be built in this portion of the State within the next year.

The State produced last year about 76,642 tons of beets, for which the farmers were paid \$357,000. For supplies, fuel, labor, transportation, etc., as much more was paid. These beets produced 9,640.1 tons of sugar, worth for home consumption \$964,000.

GRAND ISLAND.

Official name of company: American Beet Sugar Company.

Built: 1890.

Capacity: 350 tons of beets daily.

This factory has probably been inspected by more people interested in the beet-sugar industry than any other one in the United States, on account of its location. The osmose process for extracting sugar from molasses was installed this year. For several years the factory accumulated a large amount of waste molasses. Some of this had been going to Norfolk to be worked and some was thrown away. This

osmose plant produced about 400 tons of brown sugar prior to the beginning of the regular campaign.

The factory employed about 200 laborers in two shifts during the regular campaign. It consumes about 75 tons of coal per day, about 35 tons of lime rock, and about 10 tons of coke. The season was quite favorable to beet production, taking it throughout. The conditions of the factory have been very much improved on account of the recent availability of the increased supply of beets coming from the irrigated fields in the western part of the State.

NORFOLK.

Official name of company: American Beet Sugar Company.

Built: 1891.

Capacity: 350 tons of beets daily.

This factory is under the same management as the one at Grand Island, and has been in operation for some time. During seasons when there has been a shortage of beets those at Grand Island have been shipped to Norfolk for slicing. The factory is located in one of the best farming districts of the State, and the pulp is consumed by the stock on the farms.

It took considerable time for the farmers around the factories of Grand Island and Norfolk to appreciate the value of pulp for feeding. At the present time this factory is enabled to restrict its sale of pulp to its own growers. The pulp is serving as a sort of premium for growing the beets.

The factory pays \$4 for all beets of standard purity and showing 14 per cent sugar. It pays 25 cents additional for every per cent of sugar above that and a pro rata for each fraction of 1 per cent. It also pays the railroad freight of beets shipped, 25 cents a ton for beets hauled in wagons and 20 cents a ton extra for beets that have been siloed in the fields. The factory has been recently improved and its capacity materially increased.

The season was unusually wet, yet the crop of beets in this vicinity showed a good average tonnage and quality.

There is a large feeding corral near the factory, consuming considerable of the pulp produced by it. Although excessively wet at planting time, the season was quite favorable and a good stand was secured, as the beets had made considerable growth and were able to withstand the excess of moisture.

The factory opened October 5 and closed December 1.

LEAVITT (NEAR AMES).

Official name of company: The Standard Beet Sugar Company.

Built: 1899.

Capacity: 500 tons of beets daily.

The stock of beets for this factory was a little short of that for the campaign of 1902, but very much higher in sugar content, averaging about 15 per cent during the campaign. This enabled the factory to produce a proportionately larger amount of sugar.

In the beet-growing area surrounding the factory, the season was considered generally unfavorable. A snowstorm and heavy frost the latter part of April materially injured the beets. Heavy rains and floods damaged the crops in the bottom lands, thus affecting a considerable portion of the area planted near the factory. Two hailstorms also damaged the beets in their early growth while they were young and tender. The large yield of sugar from the stock of beets worked by this factory during the past campaign was due to the high quality of beets from irrigated sections in the western part of the State, about one-half of the stock received by this factory being from this source.

The factory is surrounded by large stock-feeding interests and its entire production of pulp has been utilized from the start for feeding. Near the factory site 19,000 head of sheep were fed and about 1,000 head of cattle. Farmers, generally, are calling for the pulp. About 250 men were employed in the factory. The campaign opened October 5 and closed December 20.

NEW YORK.

The State has two factories, one at Lyons and one at Binghamton. Several years ago a factory was constructed at Rome, in this State, of 200 tons capacity. It operated two years and, proving inefficient, closed.

For the past two years the State has been producing a little over 3,000 tons of sugar, and the farmers have received for beets grown about \$165,000 annually. The State has been paying in bounties to foster this industry about \$30,000 per year. The farmers receive for their beets \$5 per ton. The pulp is all sold to dairymen and stock feeders at about \$1 per ton at retail. Both factories in operation have been remodeled and very much improved during the past two years.

The State is generally well adapted to the beet-sugar industry, but its development has been retarded on account of the tendency to specialized farming. On account of location and the competition of western farmers in general farming gardening of all kinds is quite prevalent. Some localities are devoted to broom corn, others to peppermint, tobacco, cabbage, potatoes, etc.

BINGHAMTON.

Official name of company: Binghamton Beet Sugar Company.

Built: 1898.

Capacity: 600 tons of beets daily.

The early season was an average one in the district tributary to this factory, but quite dry during the summer. Its harvested acreage was considerably more than in past years. The stock of beets worked during the past campaign was nearly double that of 1902. Before the harvest closed the ground was so firmly frozen that a considerable acreage of beets could not be harvested. Farmers are becoming more accustomed to the crop and more inclined to grow beets.

LYONS.

Official name of company: Empire Sugar Company.

Built: 1899.

Capacity: 600 tons of beets daily.

The season in the immediate vicinity of the factory where most of the beets were grown, in Wayne County, was exceedingly unfavorable. A drought set in during the late spring and continued into the summer, materially affecting all of the crops grown in that part of the State. The management of this company had procured a considerably larger acreage than in any past season. A portion of its stock of beets was grown in other parts of the State not so badly affected by the drought. From these sections quite favorable returns were secured. This drought happened when the beets were young, before the taproots had reached down to the deeper moisture-bearing strata. Under such conditions beets are much more susceptible to effects of drought.

The factory has been very much improved not only in the way of increased capacity for working beets, but in efficiency in extracting a large amount of sugar. The drought affected all kinds of crops, so that the farmers are not discouraged with this one particularly. Considerable acreage of this factory also was lost by the ground freezing.

OREGON.

LAGRANDE.

Official name of company: Amalgamated Sugar Company.

Built: 1898.

Capacity: 350 tons of beets daily.

This factory from its inception has not been able to secure anything like a sufficient supply of beets. It has been difficult to induce the farmers to give the beets sufficient trial or attention. During the past season the first part was dry and unfavorable. Many acres of the planted area were lost on account of dry weather and the seed failing to germinate. Some of this was replanted, but too late. It looked in the early summer as though the crop would be practically a failure. The season turned out more favorable as it progressed, and some remarkable results were secured, some fields yielding as high as 20

tons per acre; but the area available for harvest was considerably reduced.

The crop results were irregular. Some fields went very high and others very low in tonnage, while many fields were complete failures. Considering the results in the past, however, and the losses on other crops, there is a feeling of satisfaction and a general tendency to produce for the factory next year more beets than during any former season. The farmers of this district are not experienced in intensive farming. In some places Indians were employed, and a poor class of labor generally is depended upon for doing the work.

The experience of this factory is a good illustration of the fact that the success of a sugar factory is largely dependent upon its farming community. The conditions for growing sugar beets are good and, with proper attention, the results surpass those of any other crop; yet this factory had to practically abandon its own neighborhood and go into other territory some distance from it to secure a supply of beets. Now beet growing is gradually working back and the prospects are that the factory will eventually procure a supply of beets in its own vicinity.

The factory started about September 30 and closed November 4.

OHIO.

FREMONT.

Official name of company: Continental Sugar Company.

Built: 1899.

Capacity: 350 tons of beets daily

This factory has had considerable trouble from its establishment in securing a supply of beets, but it is gradually working out of this condition, and this year its stock was more encouraging. Like the factories in New York, it has had to face and overcome a prejudice in favor of other crops. Its contract price is \$4.50 per ton. Finding that its local area was not responsive in furnishing a supply, the management has been extending its contracts over a wider area, thus materially increasing its stock for the campaign of 1903. The season was unusually favorable, tonnage was satisfactory, and the beets were higher in sugar and purity than usual.

The factory began working October 14 and closed December 6.

UTAH.

Much can be foreseen regarding the future of the beet-sugar industry in the United States by closely studying its history in Utah. In the beginning beet-sugar production in that State was attended with great difficulties and indifferent success. The farmers secured a low tonnage

per acre and the beets averaged poor in quality. Investors were very little encouraged for the first few seasons. Nothing but the indomitable determination of the class of people who are accustomed to hardships, hard work, and slow returns could have pulled the first factory through its pioneer years.

This factory had to learn by experience how to grow beets by irrigation. Gradually the tonnage, the sugar in the beets, and the extraction in the factory increased. This first factory enlarged its sugar-making capacity, added three slicing stations, connected with the factory by pipe lines, each having a capacity for slicing beets equal to that of the central plant. Under the same management two other large factories have been built, one in Utah and one in Idaho. The success of this factory also led to the building of a factory in Oregon, at Lagrande, and one in Colorado, at Greeley. At present, taking everything into consideration, the status of beet-sugar production in Utah is ideal; it is highly remunerative to everybody connected with it. There is no difficulty in securing a beet supply for the factories. The acreage producing beets is constantly increasing, and it has become necessary for each of these factories to provide additional capacity, either by building slicing stations or new factories.

The progress of the industry in Utah has been gradual and natural, each new plant being established after favorable conditions have already been developed. In some States the factories have been installed first and the conditions developed afterwards, but in Utah factories are built to meet the demands of a constantly growing beet area. The following clipping from the Salt Lake Herald, December 27, will show the development of the beet-sugar industry in the State during thirteen years:

The figures here given were furnished at the Utah Sugar Company's offices, and they illustrate the splendid condition of the industry. Since 1891 the total output of sugar has amounted to 195,000,000 pounds, worth, at 5 cents, \$9,750,000. The record for the thirteen years is as follows:

	Pounds produced.
1891.....	1, 112, 800
1892.....	1, 325, 660
1893.....	4, 100, 553
1894.....	5, 492, 592
1895.....	7, 030, 000
1896.....	9, 150, 000
1897.....	8, 676, 700
1898.....	9, 999, 850
1899.....	16, 385, 875
1900.....	17, 500, 000
1901.....	27, 000, 000
1902.....	42, 000, 000
1903 (estimated)	50, 000, 000

The estimated output for 1903 was divided among the several factories as follows:

	Pounds.
Lehi factory	23, 500, 000
Garland factory	4, 000, 000
Ogden factory	10, 000, 000
Logan factory	10, 000, 000
Lagrande (Oreg.) factory	2, 500, 000
Total	50, 000, 000

LEHI.

Official name of company: The Utah Sugar Company.

Built: 1891.

Capacity: 1,400 tons of beets daily.

The factory at this place is the first one established in the State. It has been operating thirteen seasons. It comprises a central plant having a capacity for slicing 350 tons of beets per day and for working the juice of the beets sliced at the central plant and in addition that from the three outlying slicing stations of the same capacity, which gives it a total capacity of about 1,400 tons of beets per day. The company is planning the erection of another slicing station for 1904 at Payson, accommodating Spanish Fork, Lake Shore, Benjamin, Salem, Spring Lake, and Santa Quinn. The farmers in these vicinities have contracted to produce about 4,000 acres of beets to supply this station.

The farmers tributary to the factory at Lehi, through their long experience in growing sugar beets, are in excellent condition for producing the crop. During the past season about 8,168 acres were harvested. The average yield was nearly 12 tons per acre, giving a gross return of over \$56 per acre and a net return above all expenses, including the time of the farmer, of about \$21 per acre. The season was considered fair and the farm results highly satisfactory. The factory opened September 14 and closed December 24. The tonnage of beets sliced by each station was as follows:

	Tons.
Main plant	35, 203
Springville station	36, 184
Bingham Junction station	13, 203
Provo station	12, 320
Total	96, 910

The plant averaged 1,020 tons daily; its highest run was 1,278 tons.

The acreage will be considerably increased in 1904, and with the new station will necessitate either a larger capacity for sugar making in the main plant or a longer campaign. The following clipping from the Salt Lake City Herald, December 27, gives statistics showing the gradual growth of this plant.

George Austin, agricultural superintendent of the sugar company,

considers the rapid strides of the beet industry not short of phenomenal. He quotes the following figures showing its growth:

Growth of beet-sugar industry at Lehi, Utah.

Year.	Acres planted.	Tons of beets.	Year.	Acres planted.	Tons of beets.
1891.....	1,500	9,960	1898.....	3,000	43,111
1892.....	1,500	9,816	1899.....	3,400	52,625
1893.....	2,755	26,800	1900.....	3,000	50,423
1894.....	2,850	32,694	1901.....	7,000	78,332
1905.....	3,000	38,108	1902.....	9,000	88,900
1896.....	3,200	43,150	1903.....	8,168	96,910
1897.....	3,000	18,500			

GARLAND.

Official name of company: Utah Sugar Company.

Built: 1903.

Capacity: 1,200 tons of beets daily.

This factory was constructed by the Utah Sugar Company, and was operated for the first time during the past year. It is a large plant, a fine structure of brick and steel of the most improved pattern, both in structure and equipment. It is designed eventually for 1,200 tons capacity. It is on Bear River, near its entrance to the valley containing Salt Lake. Its supply of beets during the past season was comparatively small. The factory was late in completion and in beginning its campaign.

Beets had been grown for some time past in the Bear River Valley for the factory at Lehi, so the farmers were experienced in beet growing. The company owns considerable acreage in connection with the plant. It has also constructed a large dam across the river in Bear River Canyon, and installed a 2,400-horsepower plant for generating electric current, which is transmitted about 45 miles south to Ogden, Utah, whence it is distributed to different parts of Salt Lake County. The capacity of this plant will be doubled as soon as the power is needed.

The season was very favorable and, considering the small acreage planted, results of beet growing were quite satisfactory. They were grown by 1,695 different farmers, who averaged a little less than 5 acres each. The beets taking the \$500 prize offered by the National Irrigation Congress were grown for and near this factory. Its small supply of beets during the past season was due to the limited acreage suitable for growing sugar beets and the fact that the company knew it would be late in completing the plant. This is practically a new farming district.

LOGAN.

Official name of company: Amalgamated Sugar Company.

Built: 1901.

Capacity: 400 tons of beets daily.

The season was considered quite favorable at Logan, where a factory has been in operation three seasons. The farmers are becoming pretty well accustomed to growing beets, and the land is worked into excellent condition for this purpose. The factory has gradually increased its supply of beets, and last season may be considered an average campaign. The yield was good in tonnage and quality of beets. The factory during the past summer had undergone thorough repairs. A triple osmose plant had been installed for extracting sugar from stored molasses, upon which it worked during the early fall, prior to the regular campaign, securing about 300 tons of brown sugar.

The factory started September 17 and closed December 29.

OGDEN.

Official name of company: Amalgamated Sugar Company.

Built: 1898.

Capacity: 350 tons of beets daily.

This city has had a plant in operation for six years. Farming in its territory consists largely in garden production and the raising of tomatoes for canning factories. There are several of these in the vicinity of Ogden. For this reason the factory had difficulty in interesting the farmers in growing the beets and in procuring sufficient acreage. Tomatoes have proved a hazardous crop on account of late frosts in the spring and early frosts in the fall, and there is a growing tendency to increase the acreage of beets planted. The stock of beets for this factory is generally increasing, and the last season proved an average campaign. Crop returns were very satisfactory both in tonnage and quality.

The management of this company is interested in and is planning for one or two other factories in the State in the near future, having already installed factories at Logan, Utah, and Lagrande, Oreg. During the year the factory underwent thorough repairs, a triple osmose process being installed for extracting sugar from molasses, from which it produced, prior to the beginning of regular campaign, about 300 tons of brown sugar.

The factory started September 4, closed temporarily for ten days, and completed its campaign January 9.

WASHINGTON.

WAVERLY.

Official name of company: Washington State Sugar Company.

Built: 1899.

Capacity: 350 tons of beets daily.

This factory completed its fifth campaign the past year. Its acreage planted to beets was considerably larger than in any former campaign. The season was quite favorable, and as a rule the crop was remunera-

tive to the farmers. In many respects the district is an exceptional one; the sugar content of the beets is very high. This factory district also engages in the beet-seed industry. The beets produced from the home-grown seed averaged very high in sugar content; in 1902 this average was 19 per cent. The factory has been greatly improved during the past year and is well equipped.

It has struggled against the greatest difficulties, due to inaction and lack of interest of its farming community. It has never received sufficient beets for a full campaign. The farmers did not seem to appreciate its benefits. Its growth and development have been slow but sure. The beet supply the past season was about sufficient for three-fourths of an average campaign. This is very encouraging. The proprietor, Mr. D. C. Corbin, has had much confidence from the start that his factory would eventually prove a very successful enterprise, and that its capacity would have to be doubled to meet its growing requirements.

The average yield of the district was between 8 and 10 tons, with the cost of production less than in ordinary districts. Some of the farmers produced some very fine crops and were highly repaid. The factory is gaining very much in favor among the crop producers. Indications point to a very much increased supply of beets for next year.

Formerly the pulp was allowed to lay in heaps where it was stored from the factory; now orders are being received from the farmers in every direction. The factory people and the farmers are beginning to realize their mutual relations. The factory may now be considered firmly launched on a successful career.

WISCONSIN.

MENOMONEE FALLS.

Official name of company: Wisconsin Sugar Company.

Built: 1901.

Capacity: 500 tons of beets daily.

In my former reports I have predicted that this State would develop large interests in beet-sugar production. It already has one factory in operation. One other will be built for the campaign of 1904. Three others are arranged for to be built in the next two years. The season was quite favorable and the factory at Menomonee Falls secured an unusual supply of beets. The tonnage was good and the sugar content of the beets was high. The growers are anxious to make contracts for 1904. In the future the beet-growing area of this factory will produce more beets than it can handle, and these will be turned to other plants in which the management of this factory is interested. During the past season most of the beets supplying the

factory at Menominee, Mich., on the border of Wisconsin, were grown in the State of Wisconsin. The beets grown for the factory at Menominee Falls, Wis., came from a large territory. Most of the State is being thoroughly tested in this way. All portions of the State showed good tonnage and quality of beets. The factory at Menominee Falls paid the farmers \$4.25 for beets, with an addition of 25 cents for each additional per cent of sugar above 14. The average paid at this factory was about \$4.75. In addition to this the pulp was given to the farmers who grew the beets. In this way pulp feeding is becoming general. This company has not only developed ideal conditions insuring its future success, but it has outgrown them, and is planning the construction of several other factories.

STATISTICS OF RESULTS FOR 1903.

The following table shows the results of the different beet-sugar factories in the United States during the year 1903. It is made up from data reported mostly by the managements of the various beet-sugar factories. From a few of the factories such reports were not received, and carefully authenticated information from other sources was used. In one instance the data in the table is made up from estimates based on length of campaign, capacity of factory, etc.

In these tables it will be observed that I have not inquired into the details of factory work, such as coal, lime rock, labor, etc., as in the past. While I consider this detailed information as valuable—it is so largely to the factories—I found that not enough factories are inclined to furnish such detailed information to make the tables complete and comprehensive. I have left the continuance of this work to be carried out by the organization of the sugar manufacturers if it is thought desirable. The average tonnage per acre and the average extraction of sugar have been calculated from the data contained in other columns.

General factory and farm results for 1903.

Factory No.	Acreage of beets—		Average yield per acre.	Beets worked.	Sugar manufactured.		Price of beets per ton.
	Planted.	Harvested.					
	<i>Acres.</i>	<i>Acres.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Pounds.</i>	<i>Tons.</i>	
1.....	5,240	4,700	11.012	51,760	10,658,400	5,329.2	\$4.85
2.....	4,000	3,000	7.392	22,117	4,958,000	2,479.0	5.25
3.....	3,000	3,000	6.666	20,000	4,000,000	2,000.0	4.75
4.....	.....	8,168	11.864	96,910	23,500,000	11,750.0	4.75
5.....	4,160	3,823	11.683	44,485	10,187,000	5,093.5	4.50
6.....	3,706	3,423	12.085	41,369	10,094,100	5,047.0	4.50
7.....	2,700	1,901	6.323	12,021	2,807,700	1,403.8	4.50
8.....	2,109	2,000	8.539	17,079	4,091,339	2,045.7	5.51
9.....	5,500	5,000	8.000	40,000	8,000,000	4,000.0	5.00
10.....	.....	3,000	7.468	22,406	5,691,348	2,845.7	5.00
11.....	6,000	5,000	6.689	33,445	8,678,900	4,339.4	4.75
12.....	.....	3,000	7.092	21,277	5,237,200	2,618.6	4.75
13.....	.....	3,000	7.306	21,920	5,364,300	2,682.1	4.50
14.....	.....	3,500	11.142	39,000	8,470,000	4,235.0	4.85
15.....	3,850	3,500	11.685	43,190	10,720,000	5,360.0	4.75
16.....	3,700	3,696	9.242	55,453	12,879,600	6,439.8	5.02
17.....	6,666	6,000	9.902	59,415	14,092,400	7,046.2	4.75
18.....	.....	6,000	9.902	59,415	14,092,400	7,046.2	4.75
19.....	.....	4,324	4.863	21,030	4,959,586	2,479.8	4.75
.....	.....	15,722	9.006	141,500	31,130,000	15,565.0	4.50

General factory and farm results for 1903—Continued.

Factory No.	Acreage of beets—		Average yield per acre.	Beets worked.	Sugar manufactured.		Price of beets per ton.
	Planted.	Harvested.					
	<i>Acres.</i>	<i>Acres.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Pounds.</i>	<i>Tons.</i>	
20.....	18,000	17,000	9.471	161,013	43,532,200	21,766.1	\$4.75
21.....	5,685	5,484	11.205	62,000	16,000,000	8,000.0	4.50
22.....	7,247	5,500	10.000	55,000	12,100,000	6,050.0	4.50
23.....	7,399	6,889	5.806	40,000	9,600,000	4,800.0	4.50
24.....	5,909	4,800	11.458	55,000	12,000,000	6,000.0	4.50
25.....	8,959	8,700	16.091	140,000	30,000,000	15,000.0	4.50
26.....	5,116	5,000	7.000	35,000	8,500,000	4,250.0	4.50
27.....	3,848	3,300	12.727	42,000	10,080,000	5,040.0	5.00
28.....	12,000	5,400	9.604	51,865	12,827,000	6,413.5	4.75
29.....	5,000	4,500	6.444	29,000	6,600,000	3,300.0	4.75
30.....	5,500	5,200	7.694	40,000	9,600,000	4,800.0	4.75
31.....	9,128	7,271	5.563	40,451	8,998,000	4,499.0	5.10
32.....	7,800	6,200	5.852	36,286	8,493,176	4,246.6	5.57
33.....		7,000	6.074	47,200	11,500,000	5,750.0	5.35
34.....	5,000	3,000	9.333	28,000	5,500,000	2,750.0	5.20
35.....	6,500	6,000	8.500	51,000	11,200,000	5,600.0	5.28
36.....	2,500	2,200	8.636	19,000	5,100,000	2,550.0	5.40
37.....		1,600	12.500	20,000	4,400,000	2,200.0	5.30
38.....	3,200	1,000	8.862	8,862	1,864,409	932.2	5.42
39.....		3,000	10.000	30,000	7,000,000	3,500.0	5.30
40.....		5,000	6.000	30,000	7,000,000	3,550.0	5.35
41.....	6,400	5,200	6.513	32,000	6,923,752	3,461.9	5.21
42.....	4,000	4,000	6.750	27,000	6,000,000	3,000.0	5.30
43.....		3,000	5.000	15,000	3,000,000	1,650.0	5.37
44.....	7,000	5,500	6.545	36,000	8,867,802	4,433.9	5.32
45.....		4,000	7.499	30,000	7,200,000	3,600.0	5.10
46.....	5,000	4,000	2.750	11,000	2,400,000	1,200.0	5.25
47.....	6,380	4,575	7.142	25,940	4,402,875	2,201.4	5.30
48.....	3,500	3,000	7.833	23,500	4,000,000	2,000.0	5.60
49.....		7,000	5.609	50,000	11,000,000	5,500.0	5.40
.....		242,576	8.418	2,076,494	481,209,087	240,604.4	4.966

The following table is based on information similar to that indicated above:

Miscellaneous data and results for 1903.

Factory No.	Campaign—			Sugar in beets.	Ex-trac-tion of sugar.	Treatment of molasses.	Pulp sold.	Price of pulp per ton.
	Opened.	Closed.	Length.					
			<i>Days.</i>	<i>Per ct.</i>	<i>Per ct.</i>		<i>Tons.</i>	
1	Oct. 12, 1903	Feb. 6, 1904	118	14.8	10.29	Stored for feed.....	6,000	\$0.50
2	Sept. 19, 1903	Dec. 8, 1903	81	15.8	11.20	.....	.....	.....
3	Dec. 9, 1903				10.00	.....	.....	.....
4	Sept. 14, 1903	Dec. 24, 1903	101		12.12	.....	.....	.....
5	Sept. 4, 1903	Jan. 9, 1904	118		11.44	Osmose.....	10,000	.40
6	Sept. 17, 1903	Dec. 29, 1903	104		12.10	do.....	10,000	.50
7	Sept. 30, 1903	Nov. 4, 1903	36		11.66	Thrown away.....	4,000	.50
8	Oct. 14, 1903	Dec. 6, 1903	54		11.97	Sold to M. C. C. for making alcohol and potash.	All.	(a)
9	Nov. 25, 1903	Jan. 1, 1904	38		10.00	.....	.....	.....
10	Oct. 20, 1903	Dec. 29, 1903	70		12.70	Sold, 3 cents per gallon.....	.....	.....
11	Oct. 5, 1903	Dec. 20, 1903	77	15.0	12.97	Steffens.....	(b)	.....
12	do	Dec. 1, 1903	58		12.30	.....	.....	.....
13	do				12.23	.....	.....	.....
14	Oct. 1, 1903	Dec. 1, 1903			10.85	Osmose.....	.....	.....
15	Sept. 14, 1903	Dec. 21, 1903	99		12.41	.....	.....	.....
16	July 25, 1903	Nov. 12, 1903	109	18.5	11.61	Osmose and stock feed.....	9,000	1.00
17	Aug. 8, 1903	Oct. 30, 1903	82		11.85	.....	.....	.....
18			50	16.13	11.31	.....	.....	.....
19	Sept. 9, 1903	Dec. 3, 1903	86		11.00	.....	.....	.....
20	June 27, 1903	Oct. 16, 1903	107		13.51	.....	.....	.....
21	July 18, 1903	Dec. 13, 1903	149		12.90	Fed with pulp and bean straw.....	27,280	.15
22	Oct. 1, 1903				11.00	.....	.....	.....
23	do	Jan. 10, 1904	102		12.00	.....	.....	.....
24	Oct. 10, 1903	Jan. 17, 1904	100	16.5	10.90	.....	20,000	.35
25	Oct. 1, 1903	Jan. 23, 1904	107	15.6	10.71	Osmose.....	.....	.....
26	Dec. 18, 1903	Feb. 14, 1904	58	14.5	12.14	Steffens.....	.....	.....
27	Nov. 5, 1903	Jan. 20, 1904	77	15.5	12.00	.....	.....	.....
28	Oct. 5, 1903		62		12.36	Steffens.....	.....	.....
29	Oct. 8, 1903	Dec. 25, 1903	72		11.37	.....	.....	.....

a Contract.

b Most of it given to farmers.

Miscellaneous data and results for 1903—Continued.

Factory No.	Campaign—			Sugar in beets.	Extraction of sugar.	Treatment of molasses.	Pulp sold.	Price of pulp per ton,
	Opened.	Closed.	Length.					
			<i>Days.</i>	<i>Per ct.</i>	<i>Per ct.</i>		<i>Tons.</i>	
30	Nov. 23, 1903	Feb. 3, 1904	73	.....	12.00	.....	.....	.....
31	Oct. 27, 1903	Dec. 28, 1903	63	14.5	11.12	Mixed with dried pulp ...	562	\$10.00
32	Oct. 8, 1903	Dec. 13, 1903	67	.....	11.70	Sold to M. C. C. for making alcohol and potash.	2,000	.25
33	Oct. 22, 1903	Dec. 17, 1903	61	.....	12.18	.....	.....	.....
34	Oct. 26, 1903	Dec. 29, 1903	65	.....	9.82	.....	None.	.....
35	Oct. 22, 1903	Jan. 13, 1904	84	.....	10.98	All dried with pulp.	(a)	12.00
36	Oct. 19, 1903	Dec. 31, 1903	74	.....	13.42	Sold for cattle and horse feed.	Half.	Free.
37	Oct. 21, 1903	Dec. 20, 1903	60	.....	11.00	.....	.....	.....
38	Oct. 19, 1903	Dec. 2, 1903	45	14.2	10.51	Sold to M. C. C. for making alcohol and potash.	None.	.....
39	.....	Dec. 21, 1903	.....	.....	11.66	.....	.....	.....
40	Oct. 23, 1903	.....do.....	60	14.0	11.83	.....	.....	.....
41	Oct. 28, 1903	Jan. 2, 1904	67	.....	10.81	.....	(b)	.....
42	Oct. 22, 1903	Dec. 26, 1903	66	.....	11.11	.....	.....	.....
43	Nov. 1, 1903	Dec. 31, 1903	60	14.0	11.00	.....	.....	.....
44	Oct. 15, 1903	.....do.....	78	.....	12.31	Steffens	(c)	Free.
45	Nov. 18, 1903	Dec. 29, 1903	42	.....	12.00	.....	.....	.....
46	Nov. 25, 1903	Jan. 6, 1904	42	.....	10.99	.....	.....	.....
47	Dec. 5, 1903	Jan. 20, 1904	47	.....	8.48	Sold to M. C. C. for making alcohol and potash.	.....	.....
48	Nov. 25, 1903	Jan. 25, 1904	62	12.8	8.51	Sold.	.....	Free.
49	Oct. 10, 1903	Jan. 12, 1904	90	.....	10.60	.....	.....	.....

a All dried with molasses.

b Small amount given to farmers.

c Farmers took 10 per cent.

EXHIBITIONS AND PRIZES.

The stimulus and education affecting the beet-sugar industry by means of fairs and competitive exhibitions is fast assuming importance through the various mediums of private, municipal, county, State, and National assemblages. The beet-sugar industry throughout its various phases is especially adapted to exposition work. There are many educational features connected with such enterprises. The points affecting the crop itself are of especial interest to the farmers.

The size, form, sugar content, purity, and tonnage per acre of beets govern the excellence of the crop. Many of our sugar factories are offering prizes, accomplishing the two purposes of general education and stimulation and of careful cultivation.

Trade and agricultural journals offer prizes on feeding tests of beets and beet pulp and tests of excellence in producing quantity and quality of sugar beets. In our cities in the beet-sugar districts large exhibit collections of beets can be found, with full records covering the history of exhibits. County fairs also give sugar beets and sugar manufacture important places on competitive lists.

At State fairs the sugar industry is thoroughly advertised and literature affecting it liberally circulated and general information touching the subject generally distributed. Throughout these various sources it is becoming more widely comprehended and appreciated. I notice that many of our States are looking to the Louisiana Purchase Exposition, at St. Louis in 1904, as the great opportunity for awakening

the general public as to the beet-sugar resources of these States. In many of them the chief feature of agricultural exhibits will be centered in the beet-sugar industry. The plans are quite elaborate, and the people visiting that exposition will have an opportunity of viewing this industry as they have never seen it before.

Hitherto it has been one of minor importance. It has now assumed a position of such magnitude that its resources will be thoroughly advertised and represented. The people will be given an opportunity to witness every feature that can be brought into a public exhibition demonstrating the methods affecting its work. A miniature factory will be in operation; the feature of irrigation as employed in this industry will be thoroughly illustrated; seeding, cultivation, and harvesting will have important places.

The States devoted to this industry will give special attention at their State buildings to their local resources in sugar production. Sample beets showing all the qualities of form, size, etc., will be on exhibition. By-products will be shown; also home-grown seed, in comparison with foreign; and all the known features and advantages of the industry will compete with each other, attracting public attention to their various qualities.

PRIZE CONTEST AT THE TRANS-MISSISSIPPI COMMERCIAL CONGRESS.

One of the chief features of the trans-Mississippi Commercial Congress was a prize contest for the best specimen of beets grown in the country. Mr. H. C. Havemeyer, of New York City, offered a prize of \$500 to the winner growing the best beets. The rules of contest were arranged by the association, and a \$500 loving cup was the reward. A farmer, Mr. A. R. Rhodes, growing beets for the factory at Garland, Utah, was the winner. This factory is operated by the Utah Sugar Company. Beets grown in all parts of the country came into this contest. The early date of this meeting was unfortunate to most of the exhibitors, as from most localities beets were not sufficiently ripe.

The following report of this prize beet contest was made by Mr. George E. Herz, of Idaho Falls, Idaho, one of the judges of the contest:

ST. ANTHONY, IDAHO, *January 8, 1904.*

MR. C. F. SAYLOR, *Des Moines, Iowa.*

DEAR SIR: Your letter of December 21, addressed to Mr. A. J. McNune, has been forwarded to Mr. Beardsley, secretary of the Irrigation Congress in Ogden, and by him referred to me with the request to communicate directly with you.

I take pleasure in answering your questions regarding the reward of the Havemeyer cup, to wit:

The following rules to govern the contest were decided on in a meeting of the exhibitors and beet growers present and represented in Ogden: General appearance and shape of beets, maximum, 33 points; sugar per cent, 14 per cent to carry 30

purity, and every per cent above 14 per cent 2 points more; purity, 80 per cent to carry 20 points, every per cent above 1 point.

The meeting appointed as judges Professor Woldtsoe, Agricultural College, Logan, Utah; Mr. William K. Winterhalter, agricultural superintendent, American Beet Sugar Company, Rockyford, Colo.; and the writer as chairman. To act as chemists: Prof. George W. Shaw, University of California, and Dr. William Lawson, consulting chemist Utah Sugar Company. Beets to be analyzed in the laboratory of the Amalgamated Sugar Company, Ogden, Utah.

According to the general rules of the exhibit each sample had to consist of six beets. These we judged as to shape, etc., each judge awarding points separately, then points were totaled and divided by three; hence the fractions in the first column. Out of each sample (allowing but one for each exhibitor) we selected three beets, which were classified by numbers, sacked and sealed and forwarded to the laboratory.

The inclosed list explains itself. To this I may add that, so far as shape was concerned, the Colorado beets, especially from Greeley, came as near being perfect as I have ever seen during the twenty-four years I have been in the business, but their sugar and purity were very low. The California beets disappointed in sugar; it was only natural to presume that the Los Alamitos and Betteravia beets would be perfectly ripe by the middle of September. The selection of samples was evidently made by a person unfamiliar with the object. The Utah and especially the Idaho beets were surprisingly high in sugar and purity, especially considering the late planting, the way in which they were neglected during thinning and hoeing; in fact, all the drawbacks of a first year of this industry.

I hope that I have covered every point; should there be any other information on the subject which you desire, I shall be glad to furnish same. In the meantime I beg to remain,

Respectfully, yours,

GEO. E. HERZ.

Results of examination of beets.

No.	Name of exhibitor.	Location.	Shape points.	Sugar points.	Purity points.	Total number of points.
1	O. W. Warner	Moab, Utah.....	11 $\frac{1}{2}$	5.6	61.1	.....
2	D. H. Logan	Garden City, Kans.....	11 $\frac{1}{2}$	12.0	76.0	.....
3	J. L. Deisem	do	13	.....	.....	No analysis.
80	Charter Pennington	do	11 $\frac{1}{2}$	12.8	82.8	.....
78	E. Hansey	Hyde Park, Utah	23 $\frac{1}{2}$	14.4	88.7	84
79	J. E. Hansey	do	23 $\frac{1}{2}$	14.4	84.9	79
7	Utah Sugar Company	Garland, Utah	26 $\frac{1}{2}$	16.6	90.01	92
9	A. Rhodes	do	26 $\frac{1}{2}$	17.0	89.9	93
10	Geo. A. Pincock	Wilford, Idaho	17	13.4	.....	.....
11	Joseph Garden	Austin, Utah	25 $\frac{1}{2}$	11.8	83.8	.....
12	Jac. Thomas	do	13 $\frac{1}{2}$	15.4	80.02	66
13	J. W. Lowe	do	27	13.8	83.5	.....
14	J. A. Moore	Elsinore, Utah	21 $\frac{1}{2}$	13.4	84.2	.....
15	John E. Pincock	Teton, Idaho	12 $\frac{1}{2}$	.....	.....	.....
16	J. B. Mason	Parker, Idaho	9 $\frac{1}{2}$	17.6	90.0	76
17	Austin Bros.	Rexburg, Idaho	27 $\frac{1}{2}$	14.8	90.0	89
18	A. T. Lawrence	Shelley, Idaho	22	14.8	87.4	81
19	Idaho Sugar Co.	Idaho Falls, Idaho	19 $\frac{1}{2}$	14.2	86.1	75
20	C. W. Rockford	do	19 $\frac{1}{2}$	14.8	87.7	80
21	John Crapo	Parker, Idaho	20 $\frac{1}{2}$	17.2	87.6	83
22	D. Frederick	Austin, Utah	20 $\frac{1}{2}$	14.9	84.9	78
23	N. E. Melleon	Elsinore, Utah	18	13.3	85.4	.....
24	D. E. Miller	Parker, Idaho	12	12.0	86.0	.....
25	N. Foreman	Austin, Utah	19	12.4	88.01	.....
26	John Spiers	Plain City, Utah	4 $\frac{1}{2}$	5.9	79.0	.....
27	Geo. B. Reeder	Brigham City, Utah	9	12.6	81.1	.....
28	Peter Peterson	do	2 $\frac{1}{2}$	8.2	62.6	.....
29	C. Winget	Austin, Utah	16 $\frac{1}{2}$	13.8	84.8	.....
30	Don Davis	Elsinore, Utah	14 $\frac{1}{2}$	13.8	83.9	.....
31	A. P. Jarrell	Riverdale, Utah	31.7	.....	.....	.....
32	Parley Washburn	Austin, Utah	17 $\frac{1}{2}$	13.8	87.9	.....
33	C. Simons	do	15 $\frac{1}{2}$	12.0	84.1	.....
34	Robert Doxford	do	21 $\frac{1}{2}$	16.4	87.4	84
35	Union Sugar Co.	Betteravia, Utah	23 $\frac{1}{2}$	16.0	88.5	86
36	Los Alamitos Sugar Co.	Los Alamitos, Cal	20 $\frac{1}{2}$	15.6	87.1	80

Results of examination of beets—Continued.

No.	Name of exhibitor.	Location.	Shape points.	Sugar points.	Purity points.	Total number of points.
37	E. L. Hutchins.....	Elsinore, Utah.....	17.73	15.2	88.2	78
38	Jas. F. Shaw.....	do.....	18	14.2	85.5	74
81	J. Rowley.....	do.....	14½	12.6	80.1	.....
39	J. Lockman.....	Marysville, Idaho.....	18	14.8	85.2	75
40	J. S. Steele.....	Loveland, Colo.....	23	14.9	87.5	83
41	Great Western Sugar Co.....	do.....	22½	15.7	87.6	84
42	David Barnes.....	do.....	22½	16.4	88.5	86
43	C. H. Turner.....	Greeley, Colo.....	29	9.4	82.4	.....
44	James R. Sterman.....	Salem, Colo.....	15½	14.4	85.0	72
45	L. M. Davis.....	Parker, Idaho.....	15½	13.8	88.4	.....
46	J. A. Crapo.....	do.....	19½	13.7	85.3	.....
47	J. R. Baker.....	Teton, Idaho.....	12½	15.0	85.2	69
48	H. A. Grover.....	Parker, Idaho.....	9	10.4	76.9	.....
49	Amalgamated Sugar Co.....	Lagrande, Oreg.....	24½	17.0	83.6	85
50	H. Timothy.....	Greeley, Colo.....	30½	13.8	79.3	.....
51	Greeley Sugar Co.....	do.....	28½	10.4	79.9	.....
54	Longmont Sugar Co.....	Longmont, Colo.....	26½	12.4	85.1	.....
57	National Sugar Co.....	Sugar City, Colo.....	23	12.7	84.5	.....
60	Don McLean.....	Fort Collins, Colo.....	5½	10.0	72.6	.....
61	N. B. Baker.....	do.....	6	10.0	75.0	.....
62	W. L. Brush.....	do.....	7½	8.6	74.8	.....
63	Arthur Pratt.....	do.....	5½	11.0	65.1	.....
68	C. H. Gould.....	Monroe, Utah.....	22½	11.2	82.5	.....
69	A. Newby.....	do.....	16	10.6	82.2	.....
70	F. B. Gould.....	do.....	17½	12.0	86.9	.....
71	Sam Collins.....	do.....	22½	.....	.....	No analysis.
72	Chris Anderson.....	do.....	24	11.0	82.5	.....
73	L. W. Larsen.....	do.....	21½	13.4	85.4	.....
74	Andrew Brown.....	do.....	14½	14.6	88.1	74
75	J. E. Swain.....	do.....	24½	11.6	81.7	.....
76	Henry Rich.....	do.....	15½	10.4	81.4	.....
77	Yerg Yergsen.....	do.....	17½	13.8	84.5	.....

DISCUSSION OF SUGAR-BEET GROWING BY FACTORY AGRICULTURISTS.

Considering the future of the beet-sugar industry in this country, so much depends on increasing the tonnage of beets produced on our farms that I recently addressed a communication to the agriculturists of the various sugar factories, soliciting a brief discussion on their part as to the best methods of bringing this about. It is a plain case that the factories must have sufficient beets to operate them for a full campaign in order that they may work at a profit. It is just as plain that the farmers must have sufficiently high tonnage of beets per acre to compensate them for their labor and outlay. Deeming it would be of interest to everyone connected with the industry to see a compilation of views from these agricultural experts, I have arranged the discussion of each under the following heads: Necessity of larger tonnage, choice of land for beets, preparation of soil for planting, planting, cultivation, harvesting, fertilizing.

In compiling the views of these agriculturists, I have placed the name and address of each at the beginning of his discussion of each particular topic.

I introduce first the letter from myself calling out these discussions. Inasmuch as cultivation, fertilizing, etc., differ in different sections of the country, especially as between rain conditions and those conditions in which crops are grown by irrigation, I have arranged these topics,

first, under Middle and Eastern States; second, under mountain States, and, third, under coast States.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF PLANT INDUSTRY,
Des Moines, Iowa, January 29, 1904.

DEAR SIR: I assume that you will agree with me in the following proposition, that the future prosperity and development of the beet-sugar industry is dependent largely upon farm results.

The great problem has been, is now, and I think will continue to be for some time largely one of beets sufficient in quality and quantity to meet the requirements of the factory for a full campaign.

To insure the farmers' cooperation in furnishing this supply he must realize a good remuneration. I think the factories are now paying possibly as much as they can afford, and the farmers' opportunity for increased remuneration will come in a larger yield and a higher quality of beets.

The Department of Agriculture is anxious to aid the factories and farmers in this respect. I shall endeavor to secure the concise views of each agriculturist of the beet-sugar factories in the country as to the best methods of accomplishing this. They know the farmers and their methods—who get the lowest and highest yields.

In your experience what are the things necessary for producing the highest tonnage in your locality? I take it, you yourself will be interested in reading a collection of views of our factory agriculturists on this important question. Will you kindly furnish me yours at your earliest convenience, covering the points: Preparation of the soil, seeding, cultivating, harvesting, and especially fertilizing the land, and any other points that you may deem important.

I wish to compile these opinions from our experts growing sugar beets for my next report. Thanking you in advance, and inclosing an addressed flanked envelope for reply, I am,

Yours, truly,

C. F. SAYLOR,
Special Agent.

B. T. GALLOWAY, *Chief.*

NECESSITY OF LARGER TONNAGE.

MIDDLE AND EASTERN STATES.

ALL CROPS GROWN UNDER RAIN CONDITIONS.

By A. C. Carton, East Tawas, Mich.:

I think that one of the greatest reasons why farmers are not more successful in the growing of this valuable root crop is the fact that they never consider or give it a place in the proper rotation of the crops on their farms. The average farmer will not contract for the growing of sugar beets or make any preparations therefor to any extent until he has received his returns for the previous crop. This, of course, being sometime in January or February, there is no time for the preparation of the field in such a manner as it should be prepared for the growing of sugar beets to the very best advantage.

By A. F. Postel, Menomonee Falls, Wis.:

Your letter of January 28 duly received and would have been answered sooner if it had not been for the fact that we were very busy winding up our campaign.

There is no doubt that the progress of the beet-sugar industry depends in a large measure upon the development of the agricultural end of the business. It is the

foundation for the business, and the stronger it can be made the better it will be. The importance of developing the agricultural end of the business has in a good many instances been disregarded, to the detriment of not only the factories concerned but to the industry in general. So we find to-day that a good many factories have an insufficient supply of beets; that the unsuccessful beet growers become disgruntled and blame their failures not on themselves but on the crop in general, claiming that it does not pay to raise beets. This of course prejudices other farmers against beet culture and leaves the factories without a sufficient supply of beets. The price which the growers receive for their beets is such that it will pay them very well to raise them if they know how to do so successfully, as has been demonstrated by the majority of the growers who are raising beets for our factory here at Menomonee Falls, Wis., and have realized all the way from \$75 up to \$150 from an acre of sugar beets.

The first necessity is for each factory to have as manager a thoroughly competent agriculturist, not a man who has a smattering knowledge of beet culture alone—something which can be acquired with a few years' experience—but a man who understands agriculture, stock feeding, fertilization, and tillage, etc., thoroughly, and is not only competent to give advice, but also enthusiastic in his work, as otherwise his advice will not go far toward convincing a farmer. Next in line would be an experimental farm, which each factory should conduct, and where the crops grown within the territory surrounding the factory should be raised in proper rotation with sugar beets, going hand in hand with stock feeding.

H. Scilley, Leavitt, Nebr.:

I am in receipt of your letter of January 20, and agree with you heartily in saying that the success or failure of the beet-sugar industry in the United States depends entirely on the farmers—in other words, it is an agricultural proposition.

MOUNTAIN STATES.

CROPS GROWN BY IRRIGATION.

George Austin, Lehi, Utah:

Your favor of January 28 just received. I certainly agree with you that the future prosperity of the beet-sugar industry depends very largely on the results of beet culture, and my observation leads me to believe that in some cases mistakes have been made by companies not giving this, the main and most important question, the right of way over all other questions connected with this great industry.

CHOICE OF LAND FOR BEETS.

MIDDLE AND EASTERN STATES.

ALL CROPS GROWN UNDER RAIN CONDITIONS.

Jotham Allen, Alma, Mich.:

The first thing we must consider if we are going to raise a crop of beets for a sugar factory is the kind of soil we are going to put them on. It has been said by some that any soil will grow a good crop of beets that will grow a good crop of corn. From our experience we consider this far from the truth on the average farm of to-day in Michigan. No field should be put in beets that is not capable of raising at least 100 bushels of ear corn per acre in an ordinary season. Sandy soil that will raise this amount of corn is not very good for beets, because the plants are so liable to be destroyed by heavy winds moving the little particles of sharp sand over the surface of the ground, trimming the little tender leaves from the young beet plants; very

hard winds on sandy soils will move large grains of sharp sand that will bruise and cut off the stems of the beets as well as the leaves. We remember seeing 4 acres of nice beets that were all thinned and were 3 or 4 inches high almost completely destroyed in one afternoon the first week in June by a very severe wind. These were situated right on the banks of a lake, where the wind had a good, fair sweep.

Sugar beets should never, under any circumstances, be put on poor or medium sand or light soils. If you have very rich sandy or light soils that you wish to put to sugar beets, you must put them in very early so that they will get a good start before the hot sun dries the soil and the heavy winds later in the season come. Very black, sandy soils are subject to blight. The best soil for sugar beets is a good clay that has plenty of vegetable matter in it. The best way to begin raising sugar beets is to select some of the very best soil you have on your farm, and by doing this two or three seasons you will, by close observation, soon learn what land on your farm is best for the crop and the proper way to fit your poorer land for beets so you can adopt a rotation and not put the same land into beets too often. If you have never raised any beets before you had better take only a small contract, at first from 2 to 5 acres. Do not take less than 2 acres, as you can attend to 2 if you care to raise beets, and then when you sell them you will have enough to realize a little something, and if you are going to car them you are more liable to have a carload.

A. C. Carton, East Tawas, Mich.:

In my opinion complete success will never perch upon the agricultural banner until farmers, agricultural directors, and their assistants make thorough examinations of all lands upon which sugar beets are grown and are able to treat the conditions as they find them. In our territory we make an examination of the lands during the summer with a long spade and ascertain the depth of the top soil and kind of sub-soil; then by inquiry we find what the previous crop was, how many years cropped since clovered or manured, if it will be plowed in the spring or fall, whether the land is hilly or level, if it is naturally drained or underdrained, and how it is in regard to stones and stumps. After these facts have been ascertained we write the directions as to how deep to plow and how to handle this land so as to produce the best crop.

B. E. Brotherton, Croswell, Mich.:

Plant sugar beets only on the best and richest soil on the farm. Wherever a good crop of corn or potatoes can be produced sugar beets can be grown with profit. Fertility, good drainage, and proper care are very essential to this crop. Timothy sod should be avoided, but clover sod, corn, oat, or wheat stubble are suitable. In plowing use a "jointer," as it helps to pulverize the soil and lessens the labor of cultivation. Deep plowing and in narrow lands is desirable; by the former a longer, better shaped root and necessarily a larger tonnage is produced, and the latter, if the land furrows are kept open, gives good surface drainage.

Fred Steigerwald, president, Lyons, N. Y.:

Always select the very best land for sugar beets, as it is a money crop. Avoid poor, cold, wet, or late land. Do not plant on timothy sod unless it has been in other crops for at least one previous season or has been plowed in the fall.

MOUNTAIN STATES.

CROPS GROWN BY IRRIGATION.

George Austin, Lehi, Utah:

In this locality we find that the sugar beet will thrive on as many different kinds of soil as almost any other crop that I know of. Sandy loam, however, is the most

successful, as less skill is required to handle and prepare this kind of land for sugar-beet seed than with clay loam, but more fertilizer is required on the first-named soil.

COAST STATES.

CROPS GROWN PARTIALLY BY IRRIGATION.

L. Hache, Oxnard, Cal.:

Referring to your inquiry regarding the culture of sugar beets in southern California: While this crop has been a profitable one to the farmers, I will say that in my experience the growing of beets will become much more profitable when the farmer realizes that instead of planting to beets the land on which other crops have failed, or always using the same field until it has been cropped to death (this being now often the case), he will only select his best land and establish the system of rotation by which only one-third of his beet land will be planted to beets each year, using the land for other crops during the two other years, thus giving time for the soil to accumulate the necessary special plant food for the next beet crop.

PREPARATION OF SOIL FOR PLANTING.

MIDDLE AND EASTERN STATES.

ALL CROPS GROWN UNDER RAIN CONDITIONS.

Jotham Allen, Alma, Mich:

This part should be done thoroughly well for the raising of sugar beets successfully. We consider fall-plowed land the best generally, but this need not deter you from the raising of beets, because good, successful crops can be grown on spring plowing, and sometimes this is best. Potato ground, corn stubble, clover sod 1 year old, wheat stubble, and oats stubble we consider good for beets, and consider them best in the order we have named them. The first essential thing is a good plow with a good jointer attached, for no plowing should be done without a jointer for beets or anything else. We believe in plowing from 8 to 9 inches for beets, but land that has been plowed shallow should not be plowed that deep at first. We believe in plowing not over one-half inch deeper than land has previously been plowed if plowing in the spring; but if plowing in the fall it may be safe to bring up 1 inch of raw material, but not any more.

Corn stubble is probably the most particular to handle, but it can be handled all right without picking up any more corn stubs. If you have corn stubble to spring plow for beets, take a plank float and rub the stubs down thoroughly. Do this work in lands the same way you expect to plow. A lever smoothing harrow, with the teeth turned back, makes a good implement for breaking and flattening the stubs. Cut your furrow right close up to the edge of the row of stubs, being careful not to hit them, then the next furrow will cut beyond them and turn them all down in the bottom of the furrow so they will not bother in fitting or later in cultivating or seeding. Cut two more furrows just the right width to bring you up right close to the next row of corn stubs and turn them under the same way. Of course you must plow just according to your rows of corn; if crooked, you must plow crooked. It is a good plan to rub the corn stubs off in the winter or spring, when the ground is frozen hard and free from snow. If you wish to plow corn-stubble land in the fall, rub your stubs down the same as described. It is an extra good plan to disk your corn stubble after rubbing and before you plow. This cuts the stubs and fines the surface, so when you plow you turn under soil well fitted, and fitting again after plow-

ing gives your soil a double fitting and makes it thoroughly pulverized all the way through.

The fitting of land for beets is a very particular job, and one that must be done well. No person can advise on paper just what to do, because there must be good sound sense used all the time. Soils vary so much and the weather is so changeable that we have to work according to varying circumstances. The beet seed is somewhat peculiar, being made up of from two to five seed germs incased in a hard shell, and this shell is covered with a rough, fibrous coating. The soil must be very fine, so that it will fit around this rough ball closely. The land should not be plowed until dry enough so it will not bake. If land is reasonably dry it wants work done on it in fitting very soon after being plowed. More can be accomplished in two hours fining soil by working it soon after plowing than can be done in one-half day after it has been exposed twenty-four hours to hot sun and drying winds. If soil is not too wet, we follow soon after plowing with the roller or float, and soon after this with drag. Some farmers will take good soil and spoil it for starting a spring crop quickly by plowing it and letting it lay without working it any for a week or more, exposed to the sun and drying winds, which takes the moisture out, hardens, and leaves it soggy, lifeless, and incapable of starting beet seed or anything else quickly. Some farmers will take a poor piece of soil, plow it when in just the right condition, follow and prepare it at just the proper time so the soil will fine up in excellent shape, and raise a better crop from poor soil, by doing everything at the right time and in the proper way, than others will grow from a good soil.

It is impossible for me to tell you just how to work to fit your soil well, or just when you should use the roller, the drag, the float, disk harrow, or the cultivator; but you must use good judgment and use these tools at just the time when they will do the most toward fining and firming your soil. The two great essentials for a proper place to sow sugar-beet seed is to have your soil very fine and firm. The seed bed must be very firm to hold the moisture near the surface of the ground to sprout the seed, and at the same time must be very fine for the same reason. If you are sowing beets on a large scale and have several teams at work, keep some teams fitting and sowing just as fast as plowing is done. If your soil is well firmed by plenty of working and rolling it is well to use the float just ahead of the seeder, as the float leaves fewer horse tracks to bother the seeding.

Edmund Starke, Caro, Mich.:

The reason that so many of our farmers are getting such poor results in beet raising is that they do not do the work thoroughly. Only about 30 per cent of our farmers do the work as it should be done. Beets ought to be grown in proper rotation; for instance, take clover stubble, manure it heavily, and put in winter wheat; then plow the ground deep in the fall and put in beets; and after that put in summer grain, then clover again, and manure the clover stubble. It is recommendable to let the beets follow directly after the clover stubble if the farmers want to. In regard to preparation of the soil in the spring, I will say that too much extirpating and harrowing can not be done to prepare a proper seed bed. Then the ground should be rolled at least twice in order to pack it well.

A. C. Carton, East Tawas, Mich.:

The stock advice to farmers in regard to deep plowing without taking into consideration the subsoils, has done as much toward preventing the production of a good beet crop as any other advice that could be given. Deep plowing is not always advisable, especially where the subsoils are of a blue-clay nature and entirely unfitted for a seed bed. This kind of land should be subsoiled, but not plowed any deeper than the top soil, as it would be a great mistake to turn up 3 or 4 inches of this uncivilized, unacclimated, and unproductive soil for a seed bed.

H. E. Dove, Lansing, Mich.:

Another mistake which has been made in the preparation of soil was the advising of deep plowing for beets. Unquestionably deep plowing is an important thing, and yet in a community where the land has never been plowed over 6 to 8 inches, it is a serious mistake, indeed, to advise 10-inch plowing, because the very fact that we turn out 2 inches of subsoil on top of the ground means failure in securing a stand. We have always advised plowing not to exceed one-half inch deeper than the usual custom, and in this way we have no drawbacks from this cause. It is safe to say that a farmer in preparing his land determines at that time fully half the labor he will put in on the crop afterwards, and we contend that in the fitting of the land a man can kill more weeds and foul stuff by horse power than he can at any other time, and as a consequence we advise either fall plowing or spring plowing at the very earliest opportunity, fitting the land to a moderately smooth surface and then letting it lie until seeding time, which is usually from ten days to two weeks later; and then give it the final fitting, which destroys a weed crop. It is necessary also to have a perfect seed bed, and this final fitting gives us that.

A. F. Postel, Menomonee Falls, Wis.:

Deep culture, first with the aid of a subsoil plow, should be taken up, especially in heavy soils, and the beets of stubby growth and many side roots (sprangle-rooted beets) will disappear from the factory sheds and give room to long smooth beets, which will return a heavier and a better crop in every particular. Deep culture means fall plowing and subsoiling. In the spring it is the preservation of the winter moisture in the soil, which must be accomplished by proper treatment of the same, as only in case of sufficient rain in spring may a good stand be obtained. The soil must be well packed and yet left with a rough surface so that it can neither dry out nor crust over too heavily after a rain. This can be accomplished by the use of a corrugated roller or the use of the drag after a smooth roller.

H. Scilley, Leavitt, Nebr.:

We will take it for granted that the proper soil has been selected by the farmer, which should be the very best available piece he has on his farm. If this was in small grain the previous year, the surface should be double-disked, half lapping each time, so as to leave the land perfectly level. As soon as the grain is taken off in the fall, plow about 10 inches deep and as often afterwards as convenient when the land is in the proper condition as regards moisture, running the harrow right after the plow, so as to create a mulch and hold the moisture.

If it is not possible to plow in the fall, the land should be plowed in the spring as early as the season and the condition of the land will admit of the work being done; and in every case I would advise diskings the land, as above described, before plowing, as in this way you get the lower soil pulverized, enabling the soil to pack better below the surface, and consequently better fitting it to hold moisture. If this is done, and the furrows not cut too wide the surface soil will have a compact condition without any air chambers underneath, which prevent the subsoil moisture from coming up, and materially aid in drying out the soil above. Besides the lumps that form these air chambers, if the surface soil is turned under without being pulverized, seriously affect the capacity of the soil for holding the moisture that falls; and they interfere with the development of the roots of the beet, as when the plant strikes one, it generally spreads around it by sending out several roots instead of one. This not only affects the yield, but the quality also. The land should be well harrowed as soon as plowed, and the harrow should be run over it at frequent intervals until planting time, to keep the surface from crusting and to kill weeds that have sprouted. When time to plant, the land should be double-disked again, then har-

rowed well and rolled, following the roller with a very light scratch harrow, so as to leave a rough surface to the soil. Then the seed should be planted. You have thus got a fine, well-prepared seed bed, fitted to hold moisture and draw moisture from below, and in a condition to allow the beet roots to go down and penetrate the subsoil.

MOUNTAIN STATES.

CROPS GROWN BY IRRIGATION.

Mark Austin, Idaho Falls, Idaho:

Our experience has been that deep fall plowing to a depth of about 12 inches is best, providing the soil is of sufficient depth to allow it. However, we find that it is unwise to turn up more than 1 inch of new soil in any one year, as soil that has never been exposed to the elements will not properly germinate the seed nor encourage its growth, and it is somewhat dead; and where soils are too shallow to allow the proper depth of plowing we find it advantageous to plow as deep as the soil will allow and then subsoil it.

H. Timothy, Greeley, Colo.:

The land should be plowed in the fall 9 to 12 inches deep, and as soon as we can get on it in the spring we harrow crosswise lightly; then we let the land lie until a few days before we want to plant when we take a leveler and level crosswise, and harrow well, so as to give us a good seed bed.

George Austin, Lehi, Utah:

Deep fall plowing is very necessary, and particularly in this high altitude, in all cases, as this treatment has a tendency to retain the moisture near the surface, which is very essential, as the beet seed must be planted shallow to insure a good stand of plants.

COAST STATES.

CROPS GROWN PARTIALLY BY IRRIGATION.

L. Hache, Oxnard, Cal.:

As to the preparation of the soil, seeding, cultivating, and harvesting, outside of the general outlines little can be said. The farmer should use his own judgment in taking care of the crop or be advised by the factory local agriculturists. The land selected for beets should be in good tilth, with a deep, porous soil, plowed to a depth of no less than 12 inches, well worked down with harrow and roller, so as to pulverize the clods and fill up all cracks which may have been left in plowing, always taking care to retain the moisture near the surface.

J. Ross Clark, Los Alamitos, Cal.:

In this locality the soil should be well watered before seeding; if rains are light, they should be supplemented by irrigation, so as to be sure that the upper and lower moisture meets. Deep plowing; thorough pulverization; seed bed well firmed to depth of 3 or 4 inches.

PLANTING.

MIDDLE AND EASTERN STATES.

ALL CROPS GROWN UNDER RAIN CONDITIONS.

Jotham Allen, Alma, Mich.:

This is only a short job if you have or can procure a two-horse seeder. If you are only sowing from 2 to 5 acres it is not very much of a job to drill them with a hand

drill. If the ground is fitted firm and solid, as it should be, and well fined, $2\frac{1}{2}$ acres can be drilled in a day, where rows are 18 inches apart, with a common hand seeder. If you are drilling your beets very early (say before the middle of May, in this climate—Michigan), you must be very careful and drill them very shallow—not over one-half inch deep, for if you drill deeper the seed is liable not to come up well and even unless the weather is very warm. I believe that beginners fail more times in getting a good stand of beets by drilling the seed too deep than from all other causes. Examine your drill closely; you will think it running only one-half inch deep when it is putting your seed in from 1 to $1\frac{1}{2}$ inches, which most always means a poor stand from early sowing. If drilling later in the season, beet seed can be drilled deeper with perfect safety. In fact, it should be drilled deeper so it will not dry out but will get plenty of moisture to germinate it.

It is generally safe to drill 1 inch deep if sowing after the 20th of May, although there can be no certain rule laid down for all seasons, as there is so much difference in soil conditions as well as weather conditions. I had a careless workman drill 5 acres once right on top of the ground, and it grew and made a fine stand. It was drilled the 3d of May, and the weather was cold and cloudy for the next three weeks. This seed grew, while that which was drilled down into the soil rotted on account of so much cold wet weather. I very often roll after drilling if it has been sown a little late and the soil is dry, but do not roll at any time when the soil is damp and soggy. You must use your good judgment at all times. I simply throw out a few suggestions to aid you in your judgment. Above all things do not be afraid of using plenty of seed. Sow at least 15 pounds per acre if you want to do your best for a good crop at harvest. If you have good land, with an extra good seed bed, then a good drill to sow the seed, and the weather continues fine for bringing the seed up after drilled, you may get a fine stand of beets from 10 or 12 pounds per acre; but it is very seldom that you find all of these conditions favorable. Even if everything seems all right, there may come a very heavy beating rain just after you have finished drilling and pack the surface of the soil down so that the beets will not come up well. If the soil is crusted, several seeds sprouting together may exert force enough to come up where one or two sprouts would utterly fail.

The seeds seems to have a peculiar affinity for each other, for several together will grow stronger than one alone when they are small. By drilling 8 or 10 pounds of seed per acre you may lose 4 beets per rod by getting a poor stand. If those beets weighed 1 pound apiece, it would result this way: It takes about 40 rows 40 rods long for an acre. Four 1-pound beets less per rod would be 160 pounds less per row, and 40 rows would make 6,400 pounds less per acre, which would be over 3 tons, and 3 tons, at \$5 per ton, makes a loss of \$15 per acre. If by saving 7 pounds of seed per acre, which would be \$1.05, you lose at harvest time \$15, you certainly have made a serious mistake. I have known a great many farmers to do this very thing. Let me caution you again. Do not scrimp your seed if you want to do your part to raise a good crop. Always drill 4 rows at the ends, or at right angles to the way your field is drilled. These will give you a chance to cultivate across the ends of your field and keep the weeds down. Turning around on those end rows while cultivating the main part of the field will not damage them very much.

Edmund Starke, Caro, Mich.:

One of the greatest mistakes our beet growers make is that they do not plant enough seed to the acre. In European countries, where they have followed the beet business for fifty years, they plant not less than 25 pounds per acre in order to get a good stand, and go crosswise with the cultivator, in this way bunching out with a horse-hoe. The beet is a sociable plant, like all other garden plants. It wants to grow in company for the first fourteen days after starting, and then wants to be singled out. A great many of our farmers in the Saginaw Valley think that they can get along with 5, 6, or 10 pounds of seed per acre. There is the failure of the

beet crop right at the start. If the beets come up single the weeds grow up around them; and insects and other enemies and the weather conditions make the young plants suffer so much that they never get out of their starting period for two months, when, under proper conditions, it should be in three weeks.

W. F. Sauber, Marine City, Mich.:

The farmers are very careless in the drainage of their lands throughout the State, and the heavy rains of the past two seasons have kept their lands continually flooded, and the very dry May of last season made the seeds germinate very slowly, and that being followed by a very wet and cold summer, has discouraged the growers with the crop.

They will not sow seed enough, for they will not sow on the average more than 10 pounds per acre; that brings about slow germination and growth of the young plant.

The beet seeders are not perfect. By sowing 10 pounds of seed per acre; the seeder being set so close, holds the seed, thereby producing many skips, the result being a poor stand and very often a third of a crop.

Sow sufficient seed to produce a good stand. We recommend from 20 to 30 pounds, as one plantlet helps another to come out of the ground.

B. E. Brotherton, Crosswell, Mich.:

Sugar beets should be planted as early in the spring as the weather and condition of the soil will allow. In fitting to plant this crop the soil should be thoroughly pulverized to a depth of about 3 inches, and if necessary firmed by a roller. Be sure the seed bed is fine and firm. It is generally better to roll ahead than after the seeder; likewise, it is better to plant on a rough rather than a rolled surface. To accomplish this, follow the roller with a light harrow; then follow with the drill. The rows should run crosswise at right angles with the dead furrows. It is easier to cultivate when planted in this way. The seed should be covered very shallow, not over one-half to three-fourths of an inch deep, and it will pay to plant at least 15 pounds per acre to insure an even stand.

A. F. Postel, Menomonee Falls, Wis.:

In a soil which is rich as it should be, 18 by 8 inches is the distance at which the best results will be obtained. Whenever planted wider apart in a rich soil the beets, even if rich enough in sugar, will yet contain more impurities and be more or less undesirable for the factory. It is only on a comparatively poor soil or one subject to drouth, that the beets should be planted wider apart; but such soils are not fit for beet culture and should be avoided.

The best results are obtained in planting beets after a manured crop of corn, potatoes, or clover; here the crop is heavy and rich in sugar and the purity high. This has given us the best results here on our heavy soils in Wisconsin.

H. Scilley, Leavitt, Nebr.:

Use a four-row seeder, planting the rows 18 inches apart. Use 25 or 30 pounds of seed per acre and plant from one-half to three-fourths of an inch deep. By using plenty of seed we are sure of a full stand and the outside plants protect the inner ones when they are very tender from any drifting sand or dust, which would otherwise injure the plants and retard their growth. If the surface should be crusted from a beating rain a number of sprouts will raise the crust and come through when one or two would fail.

Fred. Steigerwald, Lyons, N. Y.:

Plant the seed as shallow as possible. Deep planting will cause slow coming up and an uneven stand. By planting shallow, say one-fourth of an inch and not over three-fourths of an inch under any conditions, rolling well after planting, seed will come up quick and get ahead of the weeds.

Sow in rows from 18 to 28 inches apart. The closer together, of course, the more beets you will get on an acre.

In thinning always leave the strongest, healthiest, and most uniform-sized plants. Beets should be thinned out in the row to 6 or 8 inches apart.

MOUNTAIN STATES.

CROPS GROWN BY IRRIGATION.

Mark Austin, Idaho Falls, Idaho:

We find that frost has a tendency to thoroughly pulverize the surface of the soil, putting it in better shape for receiving beet seed. We find that the original Klein-wanzlebener seed, which we have imported from Germany, or our home-grown seed of the same kind, gives excellent results under irrigation. The seed bed should be properly prepared before receiving the seed. The time for seeding in this western country is governed entirely by the season, ranging from about the 15th of March to the 15th of May, according to the season and the conditions of the soil. The earlier we plant, however, when conditions are right, the better the results, speaking in a general way. The best results that we have obtained in the arid country from the depth of planting is from 1 to 1½ inches pressed soil upon the seed.

George Austin, Lehi, Utah:

The seeding should be very carefully done when the land is properly prepared. In this part of the country we find from about April 5 to May 5 to be the most desirable time for planting. Fifteen pounds per acre when the rows are 20 inches apart is what should be planted at a depth not to exceed 1½ inches.

COAST STATES.

CROPS GROWN PARTIALLY BY IRRIGATION.

L. Hache, Oxnard, Cal.:

Seed should be planted from 1 to 1½ inches deep, according to the conditions of the soil and moisture. Uniform depth of seed, and also uniform moisture, will insure rapid germination and an even stand, without which a beet crop is always a failure, for beets coming through the soil ten days or two weeks after the adjoining beets are already up will be found at harvest very small, most of them not worth harvesting.

Cultivating and hoeing should be done as often as possible, not only to destroy the weeds, but also to build up a loose surface 3 or 4 inches deep in order to reduce the evaporation as well as to allow the fibrous roots air in sufficient quantity.

J. Ross Clark, Los Alamitos, Cal.:

Seeding should be done immediately after a light rainfall. Fifteen pounds of seed to the acre, if late, when soil is warm; 25 pounds if early and on alkali ground. Soak seed, using care that it does not sprout before using. Rows 14 inches apart, thinned in rows to 10 to 12 inches apart.

CULTIVATION.

MIDDLE AND EASTERN STATES.

ALL CROPS GROWN UNDER RAIN CONDITIONS.

Jotham Allen, Alma, Mich.:

If the soil is very foul and weedy we cultivate once before the beets are fairly out of the ground. Unless you have an extra good horse it is well to have someone lead him in doing this early cultivation. If the one that holds the cultivator does

not have to drive the horse he can close the cultivator teeth and get very close to the row, even if the beets are not out of the ground, as he can see the drill marks and go by them unless the ground has been rolled. If you are using a single-row cultivator it should have narrow shovels. Still better are some of the little spike-tooth cultivators that will throw but very little dirt. The beets must not be covered up by dirt when they are small, as it will destroy them the same as it does weeds. Most all regular beet cultivators have shields and shear blades combined for the purpose of running close to the row of beets. These shear blades on most cultivators are made longer than they should be for the best of cultivation.

The beet cultivators, as they are put out ready for work, generally have the shear blades attached to run next to the row, and the center is cut by a triangular piece of steel riveted to a standard that fastens to the cultivator and is called a duck's foot. We consider this a very poor tool, rigged as above described, for cultivating, for it will bob over the top of the soil, pulling out a few weeds, and just brush the ground enough to make the rest grow in fine shape. Rig your cultivators over by cutting off about one-half of the shear blades. Then take the duck feet to your blacksmith and have him cut the triangular piece from the standard. Then shape and drill a hole through the standard so you can bolt on the same a narrow cultivator tooth. Get more clips and more standards to fasten narrow cultivator teeth on, and use these with the shear shields for about two cultivations. After this take your shear shields off entirely and put on standards in their places with narrow cultivator teeth. It is best to cultivate deep at first. You can not cultivate very deep with the shear shovels, but the teeth you put on to run in the center of the row between these shovels can run deep from the first, and later, when you take off the shear shovels and put on standards with small cultivator shovels next to the row, you can run these 3 inches deep. We think it best to cultivate as deep as 6 inches in the center between the rows all the fore part of the season. As the season advances you can gradually cultivate shallower.

I have seen beets stop growing entirely as a result of cultivating shallow all the early part of the season and then deep the latter part of the season. The reason of this was because, being cultivated so shallow during their rapid growth, the roots had grown close to the top of the soil, and by cultivating deeper later a large amount of these feeding roots were destroyed, whereas if the deep cultivation had been done early in the season the beets would have gone down deeper before they threw out so many lateral feeders, which would have made them stand the drought better later in the season, grow longer and larger, and therefore yield a more successful and better crop. Beets should be cultivated just after every rain, if possible. Do not be afraid of cultivating too late in the season if you cultivate as I have described—deep at first and shallower as the season advances.

Edmund Starke, Caro, Mich.:

If the seed is sowed thick enough, say 20 to 25 pounds per acre, and the seed bed is properly prepared, the plants will come up within a week to ten days, and after fourteen days the cultivator can go between them and it gladdens the grower's heart to work in them. The bunching and singling out of the plants can be done in the proper time, so that within a month from seeding the plants are single, the rows being 18 inches apart and the beets 8 inches apart in the rows, so that in every square foot of land there is a beet. This as a most perfect stand will give a high tonnage—15 tons and over—and a good sugar percentage, which will run from 14 per cent to 18 per cent. With a poor stand this can not be accomplished.

The rest of the cultivation can be done with a cultivator if land has been in good cultivation before and free from weeds. Otherwise the hand hoe must be used as the beets demand to be free of weeds around the plant. In the proper beet cultivation in Germany we always make it a rule to give the beets a good hand

hoeing twice, no matter if there are weeds in them or not, and to go through with the cultivator every ten days.

A. C. Carton, East Tawas, Mich.:

Perhaps I am going out of my latitude a little when I say that the future profitable beet crops must be raised in this country without the assistance of the hand hoe after the beets are properly blocked and thinned. The hoe that used to be in evidence in the cornfield in days gone by has long since been placed in cold storage, and the hoes that have been used in the past in the hoeing of the beet crop after the beets have been properly blocked and thinned will follow in the footsteps of the corn hoe. The hand hoe might have been an important agricultural implement in ancient times, but in the future it will only be admired in pictures, the same as "The Man with the Hoe" has been in the last few years. In the future the horse cultivator will do the work of many hoes, and the old idea that beets should not have any dirt thrown toward them must be abandoned.

The American sugar-beet crop must be Americanized. The conditions are entirely different from those existing in Germany, where wheat, oats, and cereal crops are hoed. It is all right to Germanize in Germany, but in a country like ours, where the price of labor is so high, we must Americanize everything that we do. The guards on the cultivator, which protect the beets when small, should be removed, and the dirt should be gradually worked toward the beet, which will smother any weeds that have started to grow between the beets.

As soon as the farmer gives these things his more serious consideration, drains his lands, gives his beet crop a proper place in the rotation of his crops, makes an examination of his topsoils and subsoils, and treats the conditions as he finds them, kills his weed crop the previous year, plants his beets early in the season, narrows the rows to 16 inches instead of 24 inches, and blocks and thins them 10 inches apart instead of 7 inches, throws the hand hoe in the scrap pile and uses the horse cultivator unsparingly, the beet crop will take its place among the most valuable crops that a farmer can raise; but as long as the farmer waits until spring before he makes any preparations for his beet crop, and then puts in whatever old field that he has not made calculations on for any other crop, poorly fits it, and then pays out a large amount of money for help to use hand hoes the greater part of the summer, the beet crop will be a failure and a bugbear to the farmer. The gross receipts from the sugar-beet crop would be entirely satisfactory if such a large portion of it did not have to be paid out for hand labor.

In the future the farmer's efforts should be directed toward the better preparation of his land and the Americanizing of the crop. In this lies the future success of one of the greatest agricultural industries that this country has ever known. We should all labor together with this end in view. Let the watchword be "Americanize the sugar-beet crop."

H. E. Dove, Lansing, Mich.:

Then it is also necessary to have our drills in such a condition that the seed is not placed more than three-fourths of an inch deep. We find that at no time can beets be more cheaply thinned than when the second character leaf is about half formed, as at that time all seed is germinated and the roots have not attained such a size that it is difficult to get them out. Later on the root is so well set in the ground that the people thinning frequently break off the top but do not destroy the crown, and in consequence it is necessary to go through the second time and cut these beets out with a hoe. It is also imperative that this work of thinning be well done, leaving one beet in a place, and they should be spaced from 8 to 10 inches apart in order to produce the best yield.

We like to put on about two cultivations before thinning and as many afterwards

as possible, as our experience has taught us that the cultivator properly used will make tonnage.

W. F. Sauber, Marine City, Mich.:

The greatest evil of all is that, after the grower has the beets in the ground, he will not look after them in time for thinning and keeping the weeds down, but will take care of the beets when he can find nothing else to do; and, when he does get at them, the beets are so large and the weeds so heavy that it increases the expense of taking care of them very much and reduces the net profit of the crop.

Commence to work the ground as soon as you can to keep it loose and keep the weeds down; thin the beets when they have the fourth leaf; keep working the ground until the leaves cover it, and then lay them by; harvest as soon as they are ripe, and there is no reason why one should not raise a good rich crop of beets, providing the season is a fair growing one, with plenty of sunshine.

L. B. Dolsen, Owosso, Mich.:

After thoroughly cultivating and preparing the seed bed, making it firm, yet not so firm but that the seed will cover well, putting the seed in not to exceed three-fourths of an inch deep, starting the cultivators going as soon as the beets show themselves, doing the blocking and thinning when the fourth leaf develops, the crop is always certain to bring good returns if the land is in any shape to produce a crop.

B. E. Brotherton, Croswell, Mich.:

Should a crust form before the plants are up a roller or weeder should be used to break it. However, a weeder must be used with care and should be run crosswise of the rows. It is a good implement when properly used, even after the beets are ready to thin. Just as soon as the rows can be followed the cultivator with knife attachment should be started, even though the horse has to be led the first time through. Set these attachments so as to cut close to the rows and sharpen them often in order to do good work. As soon as the plants are large enough to escape covering the "bull tongue" attachment should take the place of the knives. With these work the soil to a depth of about 3 inches. The result will be to force the roots downward, and also to produce a cleaner root. If possible, cultivate sugar beets every week or ten days until the crop is laid by.

I. D. Suydam, St. Louis, Mich.:

First you should be careful in the selection of the soil. A light clay loam gives generally the best results. If land has been cropped for a number of years it should be well fertilized. Good deep plowing and plenty of harrowing is another important feature, getting a fine mulch and ground well packed before seeding. Fifteen to 20 pounds of seed is not too much to sow per acre with horse drill, or 12 to 15 pounds with hand drill, to insure a No. 1 stand every year. Some springs we have ideal weather to sprout the seed, and a less amount of seed those years might answer, but it is not safe to rely on.

The cultivating should commence about three or four days after drilling, before plants are up, either by cultivating the drill marks or using the weeder, or doing both, and this should be kept up as long as possible.

Too much pains can not be taken in the harvesting, taking care to remove all dirt possible and properly topping beets at the base of leaves, which saves heavy tare and leaves a good feed for stock or a fertilizer on the field.

The greatest feature of success in this locality is when the fields have been well tile drained. Very few of such fields have turned out less than 15 tons per acre, and some have gone 20.

A. F. Postel, Menomonee Falls, Wis.:

Weeds should be killed as much as possible by working the soil from time to time before seeding. The seed bed must be prepared carefully and enough seed be used, as otherwise a bad or at least a very uneven stand may result, which is not conducive to obtaining the best results, i. e., a crop of heavy tonnage and high percentage of sugar.

The early and frequent shallow cultivation of the crop is also necessary, as well as the thinning of the beets in time. The distance at which the beets are planted, has a great deal to do with results as regards richness and purity of the beets.

Some people might say that the Agricultural Experiment Stations should do and are supposed to do what I advise the factories to take in hand by conducting an experiment farm. In the first place, the soil is different in the different localities and calls for different treatment; in the second place, there is nothing so convincing as an object lesson, showing to the farmers that one can practice what he preaches, and practice it successfully; otherwise there is always room for an argument and the progress is naturally slow.

Beet culture has been largely instrumental in raising agriculture to a higher standard in the Old World, and it can't fail to do the same in the new. But it requires more than the desire of the factory owners to make dividends. They must knuckle down to the fact that they have to become educators and try to derive a good deal of satisfaction out of the mission they have to fulfill. The dividends will then take care of themselves; still more so if the beet grower is treated decently and regarded more as a coworker than a means to a purpose.

H. Scilley, Leavitt, Nebr.:

If the first cultivation was done with a hoe I think it would well pay for the expense, as the plant needs the most careful cultivation when it is small and tender; and by using a hoe the ground can be slightly stirred close up to the plants, which greatly aids their rapid development, admits of the circulation of air in the surface soil, draws moisture to the roots of the little plants, and prevents the crusting of a little ridge on each side of the row which usually follows the use of the knives on a horse cultivator. This should be done as soon as the plants get through the ground; and then follow up with a horse cultivator a few days later. When the plants have got rooted down pretty well the ground should be stirred with the cultivator about 4 or 5 inches deep, and the later cultivations should be gradually shallower so as not to interfere with or destroy the lateral roots the beets send out to gather nutriment from the soil between the rows. The beets should be hoed once after they are bunched and thinned; that is, the soil between the beets in the row should be stirred with a hoe, otherwise it will become hard and compact. This should be done by men and not by children, as it requires careful manipulation of the hoe to do a good job and do it quickly. The horse cultivation should be kept up until it is impossible to get through any more without seriously damaging the leaves. The beets ought to be cultivated as soon as possible after a heavy rain or after an irrigation, to prevent the surface from crusting and giving up the moisture again.

E. Ewel, Grand Island, Nebr.:

Yours of the 28th ultimo received. I beg to say that in our territory, especially the western and southwestern Nebraska, the land is in a very raw state of cultivation, and in order to get the very best results possible, the farms will have to be divided into smaller tracts, say from 60 to 80 acres. This necessitates bringing in more people and is, in my opinion, the most important part; if this is accomplished we will get better farming results. The farmers will have to adopt a new method of farming, or, in other words, we have to revolutionize the farming system. We have

to urge deep fall plowing, fall irrigation when available, rotating crops properly, and better cultivation during the growing season. A few of the growers of sugar beets who have taken this course are very prosperous, not only in the cultivation of sugar beets, but other crops.

At present persons planting large acreage are unable to secure the necessary hand labor at the proper time, and thereby the crop suffers to such an extent that under this condition the growing of large tracts of beets is unprofitable; on the other hand, parties planting small acreage, which they are able to work at the proper time, have very good returns, even if the season is not the most favorable.

One more and a most important point is that the farmers should haul manure on their land; and if a farmer has not enough on his own place he should during the winter months haul from town and put it in a large pile on his farm, let it rot, and then put it on his land.

In the immediate neighborhood of the factory, where we have farmers who have planted beets for us for the past fifteen years, you can see prosperity. All of them have nice, modern improved places and always money in the banks.

These conditions can only be brought about by good, thorough farming, and not by going to town three and four times a week and talking politics and sitting on the corners whittling dry-goods boxes.

MOUNTAIN STATES.

CROPS GROWN BY IRRIGATION.

Mark Austin, Idaho Falls, Idaho:

Our experience is that beets should be cultivated just as soon as you can see the rows and as near to the rows as possible without injuring the plants, at a depth of 1 to 2 inches; and should be cultivated again immediately before thinning. Then the thinning should be done as rapidly as possible, as soon as the beets show four leaves, and then they should be cultivated again not to exceed 3 inches in depth, as we find that it is injurious to the plant to cultivate too deep, because it destroys many of the roots that act as feeders to the plant. It is injurious, as it destroys a portion of the source from which the plant gets its support. Surface cultivation will cause a fine dust or mulch, thus retaining the moisture and assisting the plant in its growth.

We find that farmers have lessened their tonnage to a great extent by using water too extensively in the early growth of the plant.

This is especially so where water is plentiful, and great care should be exercised to give the plant the necessary amount of water that it requires to assist it in its growth and to avoid flooding or getting too much water while the plant is young.

Great care should be exercised in cultivation to keep the beets thoroughly clean until the foliage has grown so large that it will be injured by further cultivation; then all cultivation should cease, and any weeds that may grow thereafter should be removed by hand, as it is absolutely necessary to keep the beets clean and free from weeds, not allowing them to go to seed. In this way the farmers will get their lands cleaner and produce larger crops than they would if this important matter were neglected.

H. Timothy, Greeley, Colo.:

Plant as soon as possible after the soil is prepared so as to give the beets a chance to come up as soon as the weeds, should there be any on the land. As soon as the plants can be seen in the rows a horse cultivation should be given at once, so as to kill any weeds that might have started. Be very careful to set your cultivator so as not to cover the young plants, for if they are covered when small they will be damaged a great deal. In other words, the dirt should be thrown from the young plants so as to let them get the full benefit of the warm sun. This work being done, thinning should follow as soon as the beets have four leaves, by cutting the surplus plants out

with the hoe from 4½ to 6 inches wide, which would leave the plants from 7 to 10 inches apart in the rows, according to the richness of the soil. The surplus plants should be removed by hand, always leaving the strongest plants. This being finished the beets should be left alone for about a week, so as to let them straighten up and take a new start, as you have, to a certain extent, loosened the roots of the plants you wish to have remain. When the beets are straightened up another horse cultivation should be given. Immediately after this you should begin your second thinning and hoeing, removing all surplus plants and taking out all weeds that may be directly in the rows. Irrigation should follow, but I can not say just when, as some lands will need irrigation thirty days before others; but the beets show when they need water. Will say, however, that in northern Colorado we begin a general irrigation about June 15. After the first irrigation, as soon as the land is dry enough, you should give the beets another cultivation, so as to prevent the land from baking and cracking, and make it hold the moisture much longer, all of which is of benefit to the crop. Should any farmer with good lands follow these instructions there is no question about good results.

George Austin, Lehi, Utah:

Cultivation should commence between the rows as soon as the young plants show above the ground. Great care must be exercised not to disturb the young plants or cover them with earth.

As soon after this as possible the thinning should be done, say, when the young beets have four or six leaves, leaving the largest and the healthiest plants.

Cultivate between the rows again and so on as often as necessary, keeping down all weeds. One or two hoeings are usually required in and around the plants after the thinning is done.

The first irrigation should be deferred just as long as the beets will grow without water, as this treatment will give a longer and better-shaped beet than will be grown by early irrigation. Usually about June 20 in this part is early enough to commence watering beets. No date, however, can be set for this work. The intelligent farmer can tell when and how to irrigate his beets as well as other crops. About September 1 to 10 the last irrigation is required, as a rule. There are exceptions, however; on very sandy or gravelly land later irrigation may be necessary. In this case the farmer must be the judge.

COAST STATES.

CROPS GROWN PARTIALLY BY IRRIGATION.

L. Hache, Oxnard, Cal.:

Cultivation and hoeing should be done as often as possible, not only to destroy the weeds, but also to build up a loose surface 3 or 4 inches deep, in order to reduce the evaporation, as well as to allow the fibrous roots air in sufficient quantity.

J. Ross Clark, Los Alamitos, Cal.:

Cultivation: First with weeder, afterwards shallow, level cultivation; cultivator kept going until beets too large to get through, and done four or five times during growing season.

HARVESTING.

MIDDLE AND EASTERN STATES.

ALL CROPS GROWN UNDER RAIN CONDITIONS.

H. E. Dove, Lansing, Mich.:

We look forward to a time in the near future when our harvesting can be accomplished by machinery. We have examined several machines, but as yet have found

none to do the work at all perfectly. At the present time the hand labor is quite a serious problem, and it would be impossible to lay down any set rule by which this can be accomplished in the cheapest and best way. It seems that every agriculturist has his own method to follow, and if he has a dozen field men under him each one has an idea of his own, but we shall all meet at the common end, that hand labor is too expensive and we must have machines to do the work.

B. E. Brotherton, Croswell, Mich.:

Harvesting should be commenced in time, so that the entire crop is finished before November 10 in our latitude. It is unsafe to have beets in the ground after that date. In pulling, the beets should be knocked together, so as to remove as much dirt as possible. They should be topped at the lowest leaf line. The factory does not want the dirt nor does the grower want a high tare. It is very costly to the grower to haul and ship dirt for which the factory pays nothing, and besides it deprives the farm of its best top soil. The best and most satisfactory way of overcoming tare on beets to be delivered after frozen weather sets in is to pit them before November 10. When beets are frozen in the small piles in the field the tare is sure to be high, and it is difficult to get them loaded, because the beets must first be picked loose from the ground. Pitting will do away with this tiresome and expensive way of handling beets for late delivery, and will allow growers much more time to get fall plowing done. It will also help to avoid the early rush in delivering and necessarily do away with much lost time waiting for cars or to unload; besides generally larger loads can be hauled after the ground is frozen.

H. Scilley, Leavitt, Nebr.:

As soon as the beets have stored the necessary sugar, which is determined by a chemical analysis, they are loosened in the ground by a beet puller, afterwards lifted out by hand, usually taking two rows and leaving the beets horizontally on the ground, the tops all being placed in the same direction, and then the rough surface on the crown of the beet, on which the leaves have grown, is cut off and the beets thrown in piles, after which they should be immediately carted off to the car or factory or covered in larger piles with dirt. If allowed to lay exposed to the sun and air the water in the beet is rapidly evaporated, causing a loss in weight and a wilted condition, making it more difficult for the factory to extract the sugar and without any resulting profits to the farmer. Part of our beets were harvested this year with a pulling and topping machine which pulls and tops the beets and leaves them in large windrows. This is the greatest saving of labor and expense, and we expect to harvest a large part of our crop in this way the coming year.

MOUNTAIN STATES.

CROPS GROWN BY IRRIGATION.

George Austin, Lehi, Utah:

Harvesting usually commences about September 10 and the crop is delivered to the factory. The beets are removed from the ground by the use of a plow made for this purpose. The tops have to be cut off at the base of the lower leaves. It costs about \$35 per acre to grow and harvest a crop of 12 tons of beets to the acre. This is considered to be about an average crop in this State. There are exceptions to this, as 27½ tons per acre were raised this season in the Bear River Valley on a 15-acre tract. This was an old alfalfa patch that had been in alfalfa for a number of years.

Beets here bring the farmer \$4.75 per ton at the factory. I think it is as much as the manufacturer can pay for beets with the present sugar content.

COAST STATES.

CROPS GROWN PARTIALLY BY IRRIGATION.

J. Ross Clark, Los Alamitos, Cal.:

Take pains to have plowing well done so as to get all the beets, and very deep to avoid cutting off roots. Best results are secured by hand topping, taking beets from soil as left by plow, topping not to be done until twenty-four hours after plowing out. The reason for this is that cutting the beets loose from the soil prevents their taking any more impurities; the beet then feeds on the top until all nutriment is extracted, thereby raising the sugar content from 1 to 2 per cent.

FERTILIZING.

MIDDLE AND EASTERN STATES.

ALL CROPS GROWN UNDER RAIN CONDITIONS.

Edmund Starke, Caro, Mich.:

Sufficient stable manure is the best, as it gives the ground all the plant food the beets need—say 20 good loads to an acre. As commercial fertilizer the old beet growers in Germany use nitrate of soda and ammonia in order to give the ground nitrogen, also phosphate fertilizers, as bone meal, etc., and potash, as the beets require a good deal of potash.

A. C. Carton, East Tawas, Mich.:

In my opinion the farmer's great mistake is in not "working up" to the crop. What I mean by working up to a crop is to have the rotation of his crops come in such a way as to always have a good clover field, pea field, or stubble field that was manured the previous year that he can plow early in the season and so cultivate as to destroy the weed crop, if any, the year before.

Next to the working up to the beet crop, the farmer should study carefully the nature of his soil, and whenever desirable to use a commercial fertilizer he should have an analysis made of the land and the different kinds of fertilizers, so as to obtain the fertilizer that will have the ingredients that his land lacks for the purpose of producing a good crop of sugar beets.

H. E. Dove, Lansing, Mich.:

Regarding the fertilizing of land, in talking up this subject with the individual contractor who puts in from 3 to 5 acres, we believe it is the best policy to advocate the use of barnyard manure; while we have faith in and advocate the use of commercial fertilizer, we find we have more success with this method than any other.

L. B. Dolsen, Owosso, Mich.:

The experience of many who have produced the highest tonnage seems to be the same, and that is, if the farmers will use drainage to take off the surplus water—either tile drains or good surface drains—and put the ground in proper shape they will receive a good tonnage. A large amount of the territory has been poorly farmed—that is, the farmers have fed no stock, or very little at the best, and with their poor modes of cultivation the crop is sure to be a failure. If, however, they would use plenty of well-rotted barnyard manure and prepare their ground right, the beet crop is certainly the best paying crop the farmers can put in. It takes the same amount of labor and expense to take care of a poor crop as it does a good crop.

A. F. Postel, Menomonee Falls, Mich.:

We know that in order to get a well-paying crop of sugar beets we must first have a rich soil. For this reason we must have stable manure, and to get that keep and

feed stock. The only way to get the best results in and the most benefit out of the beet raising is to feed the immense amount of feed derived from a good crop of beets—i. e., pulp and tops—together with what other rough and concentrated food stuffs may be raised on the farm. If a farmer would feed what he can raise on the farm and derive his income from the sale of his sugar-beet crop (or rather the sugar contained therein), butter, cream, or fat stock and put the manure produced back on the land, he would not only derive a high income from his farm but also keep up the fertility of the soil. To demonstrate this should be the aim of the experimental farm of the factory, where also, of course, experiments with artificial fertilizer may be tried in conjunction with stable manure, different ways of culture, etc. Tile drainage should be instituted wherever a heavy subsoil demands it and the advantages thereof demonstrated to the farmers.

H. Scilley, Leavitt, Nebr.:

The land in the vicinity of our factory is very rich, and the larger part of it that has been used for beet culture has not been fertilized; but where well-rotted barnyard manure has been applied (spread before plowing) the result has been a marked increase in tonnage. We prefer, however, manuring with barnyard manure the crop preceding the beet crop, as the quality of the beets will, we believe, be better than if the manure is applied the same season in which the beets are grown. Green-manuring with a nitrogenous crop, such as clover or alfalfa, will give still better results, and some of our farmers are getting ready to try this.

The tendency has been for farmers, where they grow beets at all, to take a larger acreage than they can thoroughly care for, and the work presses them so that they have to rush through and do not do it in a thorough manner nor at a time when it would be much easier to do, the result being a minimum return with a maximum expense, and a consequent prejudice against the crop. A smaller acreage thoroughly cared for would yield a larger net profit and not only encourage the farmer to continue to grow beets, but would show him that intensive farming pays, not only in the crop then being grown but in those succeeding it on the same land.

Fred Steigerwald, Lyons, Nebr.:

Do not put a coat of heavy coarse manure on your land just previous to planting. It is very apt to interfere with seeding and proper cultivating, and will cause a poor stand.

It is recommended to sow from 300 to 500 pounds of phosphate, composed of about 1 per cent ammonia, 8 per cent phosphoric acid, and 10 per cent potash, either broadcast just before sowing or drilled in at the time seed is planted, but be careful not to get too much phosphate in with the seed.

MOUNTAIN STATES.

CROPS GROWN BY IRRIGATION.

Mark Austin, Idaho Falls, Idaho:

Fertilizing of the soil is one of the main and important questions, as it is impossible for the farmer to get out of the soil something that is not in it. We have found that throughout the sections of country where alfalfa is grown successfully it is one of the best fertilizers that we can use for beet culture, by rotating with alfalfa, grain, and sugar beets. After the alfalfa has been grown upon the soil, say from two to three years, then harvest the first crop, cutting it early in the season, and when the second crop is about a foot high roll it down and plow it under, having the ground moist so that it will plow properly and cause the alfalfa to decay; then the following spring thoroughly pulverize the surface of the soil and plant the seed. In this way we have been able to raise from 20 to 25 tons per acre the first year and

from 15 to 20 tons to the acre the year following. We also find that barnyard manure, from any kind of an animal that has been fed upon alfalfa and straw, hauled out upon the soil gives excellent results.

Also the feeding of sheep, or cattle, or horses upon the soil and bedding them upon the soil on which you desire to plant beets gives excellent results; and inasmuch as the western farmers are extensively engaged in the raising of alfalfa and the feeding of sheep and cattle, it makes it possible for them to put their land in the proper shape for the raising of the beets. Our experience during the past thirteen years throughout the States of Utah, Colorado, and Idaho has demonstrated that beets can be raised at a profit to the farmer if the proper preparations are made and the necessary amount of work is applied at the right time and in the right way. We have seen a marked change in the methods of farming and a great deal higher standard of agriculture in all localities where we have established plants, and the soil has been made to yield a great deal more of all kinds of crops per acre than was raised previously. It has also been demonstrated that 20 acres, 10 acres planted to sugar beets and the other 10 acres planted to grain or alfalfa, will support an ordinary family, and they will realize more under this method of farming than the average person with 160 acres planted to grain or hay, which are the crops largely grown by the farmers through the State of Idaho.

COAST STATES.

CROPS GROWN PARTIALLY BY IRRIGATION.

L. Hache, Oxnard, Cal.:

Our experience here has been that the soil does not need plant food as much as it does humus. The experiments carried on for years at Chino and Oxnard with commercial fertilizers—nitrate of soda, superphosphate, and potash—have up to this time proved unsuccessful, when an increase of as much as 5 tons per acre was obtained by the use of green manure.

J. Ross Clark, Los Alamitos, Cal.:

Very little fertilizing is done here, as it is virgin soil, and a large portion is flooded once in about seven years from river overflow. As soils vary, an analysis is needed to determine requirements. On sandy loam good results are obtained from stable manure. Lime shows good results on heavy black soil. This is a large subject, and should be governed by the amount of humus already in the soil.

STATE BOUNTIES.

The beet-sugar industry has been encouraged more or less in some States by bounties. In some States the bounty continues for an indefinite period, and in others it is limited to a term of years. Usually the bounty is paid to the factory upon condition that a certain stipulated price be paid to the growers for beets.

NEBRASKA.

In the State of Nebraska, a bounty law was passed several years ago by one legislature. The next legislature refused to make an appropriation for this purpose. The point at issue has remained in that situation for several years. The last legislature passed an enabling act giving the sugar companies an opportunity to sue the State in order to test the legality of the law and the State's responsibility under it. The question is now pending in the courts of that State for settlement.

MICHIGAN.

The State of Michigan passed a bounty law, and immediately several factories were built, but on presentation of their claims the auditor of the State refused payment. The matter was carried through the higher courts and the action of the auditor was sustained.

MINNESOTA.

The legislature of the State of Minnesota passed a bounty law, and the sugar factory near Minneapolis was paid a bounty for one season, after that the State refused payment. Last year an enabling act was passed, the same as in Nebraska, and the matter was carried through the courts, the bounty law being finally declared unconstitutional.

NEW YORK.

From the beginning, the factories at Lyons and Binghamton have been receiving a bounty of 1 cent per pound on condition that the farmers are paid \$5 a ton for beets. During the campaign of 1902, 16,944 tons of sugar beets were produced by the factory at Binghamton, and it received in bounty from the State \$16,033; 15,661 tons of sugar beets were received at the factory at Lyons, and \$15,332.33 was received by it as bounty. The legislature had appropriated for this purpose \$50,000, so that a balance of \$18,663.77 was left. For the year 1903 the legislature appropriated for this purpose, in addition to this balance, \$30,000.

STATE OF IDAHO.

The legislature of this State, during its last session, passed a bounty law giving 1 cent for each pound of sugar produced in the State during the year 1903, and one-half cent for sugar produced in 1904. A factory was immediately constructed at Idaho Falls which manufactured sugar from beets grown during the past season, and is entitled to the bounty of 1 cent per pound on the amount of sugar made prior to January 1, 1904, and one-half cent on that made after that date. During the past summer, the construction of another factory was begun in that State at Sugar City, 30 miles north of this, and with the factory at Idaho Falls will participate in the half cent per pound bounty from the State in 1904. After 1904 the bounty ceases.

OTHER STATES.

In several other States the bounty question has been agitated, but has failed of enactment. Several States have passed laws indirectly giving special encouragement to the beet-sugar industry. In some cases taxes are not assessed against these factories for a certain period of time; in others, cities and towns are empowered to grant certain rights, franchises, locations, privileges, etc. It may be said that the bounty system has had considerable effect in stimulating the installation of factories in particular States and localities. This effect can be counted as temporary rather than permanent. The industry must rest on its own achievements.